

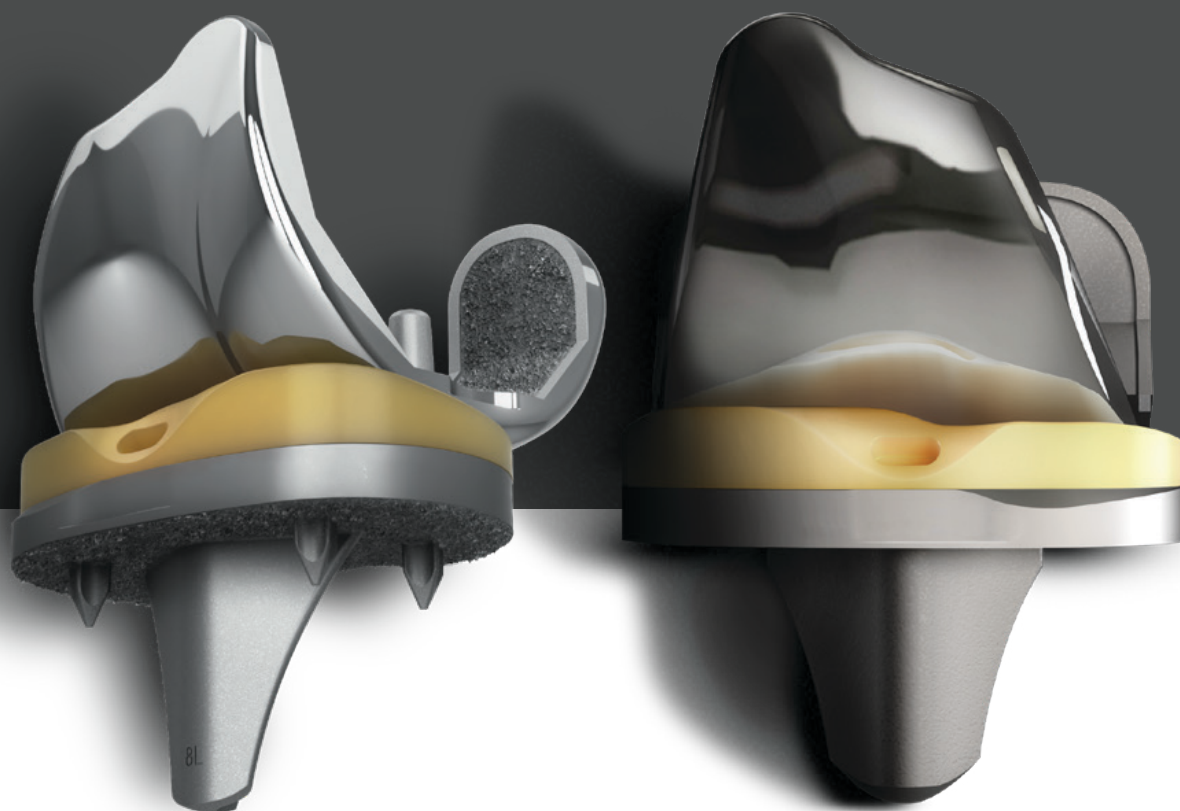
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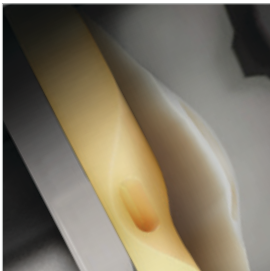
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ABSTRACT BOOK

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SURVIVORSHIP AND PATIENT OUTCOMES OF CONFORMING BEARINGS IN MODERN PRIMARY TOTAL KNEE ARTHROPLASTY: MEAN 3.5 YEAR FOLLOW-UP

Sohum K. Patel, MD a, Leonard T. Buller, MD a, Evan R. Deckard, BSE b,
R. Michael Meneghini, MD

SOURCE:

Patel, Sohum K., et al. "Survivorship and patient outcomes of conforming bearings in modern primary total knee arthroplasty: Mean 3.5 year follow-up." *The Journal of Arthroplasty*, May 2024, <https://doi.org/10.1016/j.arth.2024.04.084>.

ABSTRACT:

Background: The use of conforming and congruent bearings in total knee arthroplasty (TKA) have rapidly increased due to the benefits of increased stability and the potential for replicating normal knee kinematics. However, limited data exist for these newly available bearings. This study evaluated revision-free survivorship and patient-reported outcome measures (PROMs) of a large granular database of primary TKAs using a single conforming bearing design.

Methods: A total of 1,306 consecutive primary TKAs performed using a single conforming bearing design (85% cemented and 15% cementless) were retrospectively reviewed. Kaplan-Meier survivorship estimates were calculated based on the latest clinical follow-up. The PROMs and minimal clinically important differences were evaluated. A total of 93% of cases achieved minimum 1-year clinical followup (mean 3.5 years; range, 1 to 7), with a subset of 261 cases that achieved minimum 5-year follow-up (mean 5.8 years; range, 5 to 7).

Results: All-cause and aseptic Kaplan-Meier survivorship estimates were 97.6 (95% CI [confidence interval], 97 to 99) and 98.1% (95% CI, 97 to 99) at 7.0 years. Revision-free survivorship did not differ by cemented or cementless fixation (98 versus 97%, $P = .163$). All PROM scores significantly improved from preoperative baseline ($P < .001$), and 86% of patients achieved minimal clinically important differences for Knee Society pain and Knee Injury and Osteoarthritis Outcome Score for Joint Replacement total scores. A total of 89% of cases reported their knees to 'sometimes or always' feel normal. For cases with minimum 5-year PROMs, 93% were 'very satisfied' or 'satisfied.'

SUMMARY:

- 1306 primary TKA (85% cemented, 15% cementless)
- 93% were 'very satisfied' or 'satisfied' for cases with 5-year PROMS
- All PROM scores significantly improved from preoperative baseline ($P < .001$), and 86% of patients achieved minimally clinical important differences for Knee Society pain and Knee Injury and Osteoarthritis Outcome Score for Joint Replacement total scores.
- Conforming-bearing TKA demonstrated excellent survivorship up to 7.0 years
- Revision-free survivorship did not differ by cemented or cementless fixation

Conforming-bearing TKA demonstrated excellent survivorship up to 7.0 years. In addition, PROMs were comparable to other designs reported in the literature. While mid-term (mean 3.5-year) results are promising, long-term data are warranted on survivorship due to potential polyethylene wear in conforming bearings with more surface area in contact with articulating surfaces.

Access the full abstract and article through the [https://www.arthroplastyjournal.org/article/S0883-5403\(24\)00435-2/abstract](https://www.arthroplastyjournal.org/article/S0883-5403(24)00435-2/abstract)

DUAL-PIVOT BEARINGS IMPROVE AMBULATION AND PROMOTE INCREASED ACTIVITY LEVELS IN TOTAL KNEE ARTHROPLASTY: A MATCH-CONTROLLED RETROSPECTIVE STUDY

Sandberg, R., Deckard, E., Ziemba-Davis, M., Banks, S., Meneghini, M.

SOURCE:

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ABSTRACT:

Modern understanding of native knee kinematics reveals more complex pattern of lateral-pivot in early flexion activities, and medial-pivot in deeper flexion (i.e. dual-pivot). The purpose of this study was to compare patient outcomes with a contemporary dual-pivot TKA, designed to replicate anterior-cruciate substitution and stability, with a traditional TKA. One hundred and eighty-three dual-pivot TKAs were matched with 183 traditional non-conforming TKAs. All TKAs were cemented and performed with identical perioperative protocols. Patients were matched on age, sex, BMI, and ASA score. Patient-reported outcome measures were prospectively obtained and compared at minimum one-year follow-up. Dual-pivot TKA patients had a greater prevalence of lumbar spine disease ($p = 0.012$) and more reported their knee never feels normal preoperatively ($p = 0.012$). **Dual-pivot TKA patients reported less walking pain at latest follow-up ($p = 0.022$). Trends for greater level of participation in very active activities or impact sports ($p = 0.067$) and more reporting their knee feels normal ($p = 0.091$) were observed in dual-pivot TKAs. Patients with dual-pivot knees reported less walking pain despite greater lumbar spine disease, supporting the potential benefit of lateral-pivot motion in early flexion activities.** However, the groups were similar in overall satisfaction suggesting the nuances and potential ceiling-effect of patient satisfaction warrants further study.

SUMMARY:

- Compared patient outcomes with a contemporary dual-pivot TKA, designed to replicate anterior-cruciate substitution and stability, with a traditional TKA.
- Dual-pivot TKA patients had a greater prevalence of lumbar spine disease ($p = 0.012$) and more reported their knee never feels normal preoperatively ($p = 0.012$). Dual-pivot TKA patients reported less walking pain at latest follow-up ($p = 0.022$). Trends for greater level of participation in very active activities or impact sports ($p = 0.067$) and more reporting their knee feels normal postoperatively ($p = 0.091$) were observed in dual-pivot TKAs.
- Patients with dual-pivot knees reported less walking pain despite greater lumbar spine disease, supporting the potential benefit of lateral-pivot motion in early flexion activities. Groups were similar in overall satisfaction suggesting the nuances and potential ceiling-effect of patient satisfaction warrants further study.

Access the full abstract and article through the [The Knee Journal \(2019\) 1243 – 1249.](#)

A DUAL-PIVOT PATTERN SIMULATING NATIVE KNEE KINEMATICS OPTIMIZES FUNCTIONAL OUTCOMES AFTER TOTAL KNEE ARTHROPLASTY

R. Michael Meneghini, Evan R. Deckard, Marshall K. Ishmael, Mary Ziemba-Davis

SOURCE:

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ABSTRACT:

Few studies on kinematics correlate patterns to functional outcomes after total knee arthroplasty (TKA). The purpose of this study was to determine if lateral pivot motion in early flexion and medial pivot in high flexion, simulating native knee kinematics, produces superior clinical outcomes. One hundred twenty consecutive TKAs were performed using sensor trials to record intraoperative knee kinematics. Lateral and medial pivot pattern designations were based on the center of rotation within 3 flexion zones: 0°-45° (early), 45°-90° (mid), and 90° to full flexion (late). Knee Society Scores, pain scores, and patient satisfaction were analyzed in relation to kinematic patterns. The results showed that Knee Society function scores were higher in TKAs with early lateral pivot/late medial pivot intraoperative kinematics compared to all other kinematic patterns ($P = .018$), and there was a greater decrease in the proportion of patients who reported that their knee never feels normal ($P = .011$). Early lateral/late medial pivot patterns had greater function scores at 1-year ($P < .001$) and greater improvement from preoperative baseline ($P = .008$) compared to those with the least ideal pattern. All patients with the most ideal pattern (early lateral, late medial) compared to none of the least ideal pattern reported they were very satisfied ($P = .003$). **Patients with an intraoperative early lateral pivot pattern followed by medial pivot motion in later flexion, reported higher functional outcome scores along with higher overall patient satisfaction. Replicating the dual-pivot kinematic pattern observed in native knees may improve function and satisfaction after TKA.**

SUMMARY:

- The purpose of this study was to determine if lateral pivot motion in early flexion and medial pivot in high flexion, simulating native knee kinematics, produces superior clinical outcomes.
- The results showed that Knee Society function scores were higher in TKAs with early lateral pivot/late medial pivot intraoperative kinematics compared to all other kinematic patterns, there was a greater decrease in the proportion of patients who reported that their knee never felt normal, as well as higher overall patient satisfaction.
- Replicating the dual-pivot kinematic pattern observed in native knees may improve function and satisfaction after TKA.

Access the full abstract and article through the [Journal of Arthroplasty 32 \(2017\) 3009-3015.](#)

PRESS-FIT DUAL-PIVOT TOTAL KNEE ARTHROPLASTY: EARLY RESULTS WITH A MINIMUM 2-YEAR FOLLOW-UP

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Timothy J. Williams, MD

SOURCE:

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ABSTRACT:

Ultracongruent (UC) tibial bearings are being used with increasing frequency in the United States. Evidence suggests that the use of certain UC bearings may lead to improved patient satisfaction when compared with using conventional inserts. However, little is known as to what effect the use of UC tibial inserts has on bone ingrowth in uncemented total knee arthroplasty (TKA). The purpose of this study was to determine the early clinical and radiographic results of TKA using a press-fit dual-pivot design. Between 2017 and 2019, a consecutive series of 232 TKAs were implanted using a press-fit tibial and femoral component and a UC dual-pivot tibial insert. Sixty-two percent of patients were male. The average age was 56 years. Patients were followed for a minimum of 2 years (range, 24-42months) using KOOS-JR and Knee Society clinical and radiographic evaluation. No patient had more than mild knee stiffness at the final follow-up. Two patients reported moderate knee pain with stair climbing. All other patients reported either mild or no pain with activity. Knee Society pain scores averaged 42 points. Flexion averaged 118 degrees. Three knees (1.3%) were revised (one each for flexion instability, tibial plateau fracture, and suspected femoral component loosening). No other cases of femoral or tibial loosening were identified. **Although the success of uncemented TKA is determined by a variety of factors, the use of this dual-pivot knee design did not appear to influence tibial or femoral component fixation at early follow-up, yielding acceptable clinical and radiographic outcomes.**

SUMMARY:

- Cemented TKA has been the preferred fixation method historically, but more recently there is renewed interest in cementless fixation, as surgeons seek to achieve long-term biologic fixation in younger, more active, and more physically demanding patients.
- The purpose of this study was to evaluate the early clinical and radiographic results of a cementless dual-pivot design TKA and to determine what effect, if any, the increased conformity at the tibiofemoral articulation has on the initial implant fixation and stability.
- Based on the early clinical and radiographic results, the use of the EMPOWR 3D Knee™ cementless, dual-pivot knee design did not appear to influence tibial or femoral component fixation at early follow-up resulting in acceptable clinical outcomes.

Access the full abstract and article through the [**The Journal of Arthroplasty 37 \(2022\) S238-S244.**](#)

THE EFFECT OF POSTERIOR CRUCIATE LIGAMENT RELEASE ON KINEMATICS AND OUTCOMES IN PRIMARY TOTAL KNEE ARTHROPLASTY WITH A DUAL-PIVOT CONFORMING POLYETHYLENE

R. Michael Meneghini, MD, Evan R. Deckard, BSE, Scott A. Banks, PhD

SOURCE:

Department of Orthopaedic Surgery; Indiana University School of Medicine, Indianapolis, Indiana, USA; Indiana University Health Hip & Knee Center, IU Health Saxony Hospital, Fishers, Indiana, USA; Department of Mechanical & Aerospace Engineering, University of Florida, Gainesville, Florida, USA

ABSTRACT:

Ultracongruent bearings are increasingly utilized in total knee arthroplasty (TKA); however, implications of surgical technique on knee kinematics and outcomes with these bearings are not well understood. This study's purpose was to evaluate the relationship of 3-dimensional knee kinematics and patient-reported outcome measures (PROMs) in a dual-pivot congruent bearing TKA with and without posterior cruciate ligament (PCL) release. Forty patients undergoing TKA with an asymmetric ultracongruent bearing were prospectively enrolled for gait analysis preoperatively and 4 months postoperatively. Three-dimensional gait analysis was performed utilizing infrared motion capture. Knee kinematic data and PCL disposition were analyzed for correlations with PROMs. The PCL was fully released in 52.5% (21/40) of cases. Greater maximum anteroposterior femoral translation correlated with lower Knee Injury and Osteoarthritis Outcome Score for Joint Replacement ($\rho = -0.596$, $P = .012$), greater Knee Society Score pain with level walking ($\rho = 0.411$, $P = .101$), and greater Knee Society Score pain while climbing stairs ($\rho = 0.469$, $P = .058$) at 4-month follow-up. The PCL-release group was associated with greater maximum femoral anteroposterior translation (9.8 vs 5.5mm, $P = .053$) and greater maximum internal tibial rotation (6.2 vs 3.0, $P = .040$), supporting a more anterior-based position of the medial condyle. The PCL released group had lower median Knee Injury and Osteoarthritis Outcome Score for Joint Replacement scores (70.7 vs 76.3, $P = .031$) and reported that their knees "sometimes or always" feel normal less frequently (81.8% vs 92.3%, $P = .576$). With this asymmetric ultracongruent bearing TKA, preservation or partial titration release of the PCL, as opposed to full PCL release, appears to minimize deleterious anterior femoral translation and internal tibial rotation, which is correlated with optimized patient-reported outcomes.

SUMMARY:

- Ultracongruent tibial insert bearings in TKA aim to replicate native knee kinematics by allowing for posterior translation and external rotation during deep knee flexion. These bearings allow surgeons the option to fully retain, partially resect, or fully release the PCL.
- This study sought to evaluate weight-bearing knee kinematics and patient-reported outcomes measures in Primary TKA when using the Enovis EMPOWR 3D Knee™ insert bearing with and without the PCL.
- Roughly 52% of the patient cohort had a fully released PCL during surgery and then the entire cohort was evaluated to record flexion-extension, tibial internal-external rotation, abduction-adduction, femoral AP translation, walking speed, and tibiofemoral alignment. PROMs were also collected prospectively.
- The mean self-selected walking speed significantly improved from 1.1 mph preoperatively to 1.5 mph postoperatively. All PROMs scores improved from preoperative baseline to early 4-month postoperative follow-up. Global satisfaction for the cohort ("very satisfied" or "satisfied" response) was 91.7% at 4-month follow-up.
- While the early 4-month PROMs report a significant disadvantage in the "PCL Released" group, the PROMs did not significantly differ by PCL status groups at minimum 1-year follow-up suggesting that the "PCL Release" group may still be recovering and adjusting in the early period.

Access the full abstract and article through the [The Journal of Arthroplasty 37 \(2022\) S231-S237.](#)

TOTAL KNEE ARTHROPLASTY DESIGNED TO ACCOMMODATE THE PRESENCE OR ABSENCE OF THE POSTERIOR CRUCIATE LIGAMENT

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SOURCE:

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ABSTRACT:

Evidence for selecting the same total knee arthroplasty prosthesis whether the posterior cruciate ligament (PCL) is retained or resected is rarely documented. This study reports prospective midterm clinical, radiographic, and functional outcomes of a fixed-bearing design implanted using two different surgical techniques. The PCL was completely retained in 116 knees and completely resected in 43 knees. For the entire cohort, clinical knee (96+/-7) and function (92+/-13) scores and radiographic outcomes were good to excellent for 84% of patients after 5–10 years in vivo. Range of motion averaged 124°+/- 9°, with 126 knees exhibiting ≥ 120° flexion. Small differences in average knee flexion and function scores were noted, with the PCL-resected group exhibiting an average of 5° more flexion but an average function score that was 7 points lower compared to the PCL-retained group. Fluoroscopic analysis of 33 knees revealed stable tibiofemoral translations. This study demonstrates that a TKA articular design with progressive congruency in the lateral compartment can provide for femoral condyle rollback in maximal flexion activities and achieve good clinical and functional performance in patients with PCL-retained and PCL-resected TKA. This TKA design proved suitable for use with either surgical technique, providing surgeons with the choice of maintaining or sacrificing the PCL.

SUMMARY:

- This study reports on the clinical and functional performance of DJO Surgical's 3D Knee™ prosthesis wherein the PCL was either resected or preserved. This TKA design was proven suitable for use with or without the PCL, providing surgeons with the choice of maintaining or sacrificing the PCL.
- The stability scores reported within the Knee Society Score (KSS) were perfect in 94% of all patients, including both the PCL-retained and PCL-resected knees. Therefore, when the 3D Knee™ is used without the PCL, knee stability is not significantly affected.
- Similar to healthy knees, the 3D Knee™ demonstrated approximately 10 degrees of femoral external rotation which is known to aid patellar tracking and enhance quadriceps function during knee flexion. Additionally, high flexion activities such as kneeling and lunging were achieved by approximately 10mm of femoral rollback with the 3D Knee™, closely replicating healthy knee motion.

Access the full abstract and article through the [**Advances in Orthopedics \(2014\) 178156.**](#)

TIBIAL BASEPLATE POSITION AND POSTERIOR CRUCIATE LIGAMENT STATUS IMPACT PATIENT-REPORTED OUTCOMES IN CONFORMING DUAL-PIVOT BEARING TOTAL KNEE ARTHROPLASTY

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SOURCE:

Indiana University School of Medicine, Indianapolis, IN, US; Department of Orthopaedic Surgery, Indiana University School of Medicine, Indianapolis, IN, USA; IU Health Hip & Knee Center, IU Health Saxony Hospital, Fishers, IN, USA

ABSTRACT:

In an effort to optimize clinical outcomes and enhance stability, ultracongruent bearings have been increasingly used in primary total knee arthroplasty (TKA). The importance of the posterior cruciate ligament (PCL) and optimal sagittal tibial baseplate position in ultracongruent bearing TKA remains unknown. This study sought to determine whether these modifiable, surgical-technique-dependent variables meaningfully impact patient-reported outcome measures. A total of 759 primary TKAs of the same dual-pivot design performed using a consistent surgical technique between January 2016 and April 2019 were retrospectively reviewed. PCL status was recorded, and anteroposterior (AP) tibial baseplate position and posterior tibial slope were measured by two independent blinded raters. Patient-reported outcomes related to pain, function, satisfaction, and activity level were analyzed in relationship to PCL status, posterior tibial slope, and AP tibial baseplate position, in addition to other pertinent covariates. Median age and body mass index of the cohort were 68.3 years and 33.4 kg/m², respectively, with 73% being female. In multivariate analysis, partial or full release of the PCL was predictive of a knee “always” feeling normal (odds ratio 1.42, $P=.041$). Furthermore, tibial baseplate position closer to the middle of the tibia was associated with greater improvements in pain with level walking, pain while climbing stairs, and Knee Injury and Osteoarthritis Outcome Score for Joint Replacement total scores ($P<.079$). **In congruent dual-pivot bearing TKA, partially or fully releasing the PCL and AP tibial baseplate position closer to the middle of the tibia may provide greater improvement in pain and function scores at minimum 1-year follow-up.**

SUMMARY:

- Determine the importance of the posterior cruciate ligament (PCL) and optimal sagittal tibial baseplate position in ultracongruent bearing TKAs and if these impact patient-reported outcomes.
- 759 primary TKAs of the same dual-pivot design performed (consistent surgical technique) from January 2016-April 2019 were retrospectively reviewed.
- PCL status was recorded & anteroposterior (AP) tibial baseplate position and posterior tibial slope were measured by two independent blinded raters.
- Patient-reported outcomes related to pain, function, satisfaction, and activity level were analyzed in relationship to PCL status, posterior tibial slope, and AP tibial baseplate position.
- Partial or full release of the PCL was predictive of a knee “always” feeling normal (odds ratio 1.42, $P = .041$).
- Tibial baseplate position closer to the middle of the tibia was associated with greater improvements in pain with level walking, pain while climbing stairs, and knee injury.

Access the full abstract and article through the [**Arthroplasty Today 11 \(2021\) 178-186.**](#)

OPTIMIZING ASYMMETRIC NATIVE KNEE FLEXION GAP BALANCE PROMOTES SUPERIOR OUTCOMES IN PRIMARY TOTAL KNEE ARTHROPLASTY

R. Michael Meneghini, Evan R. Deckard, Lucian C. Warth, MD

SOURCE:

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ABSTRACT:

Replicating native knee kinematics remains the ultimate goal of total knee arthroplasty (TKA). Technology, such as robotics, provides robust intraoperative data; however, no evidence-based targets currently exist for improved clinical outcomes. Furthermore, some surgeons target a rectangular flexion space in TKA unlike the native knee. This study evaluated the effect of in vivo flexion gap asymmetry on patient-reported outcome measures (PROMs) in contemporary TKA. In vivo tibiofemoral joint space dimensions were measured during 129 TKAs using a calibrated tension device before and after complete posterior cruciate ligament resection. PROMs were compared based on the final dimensions and the change in flexion gap dimensions at 90° of flexion: (1) equal laxity, (2) lateral laxity, and (3) medial laxity. Groups did not differ by demographics ($P \geq 0.347$), clinical follow-up ($P = 0.134$), tibiofemoral alignment ($P = 0.498$), or preoperative PROMs ($P \geq 0.093$). Mean follow-up for the cohort was 1.5 years (range, 1-3). Pain with climbing stairs, pain while standing upright, and knees "always feeling normal" scores were superior for patients with equal or lateral laxity compared with medial laxity ($P \leq 0.064$). Pain with level walking, University of California Los Angeles activity level, KOOS JR, and satisfaction scores also tended to be superior for patients with equal or lateral laxity, although it lacked statistical significance ($P \geq 0.111$). Results of this study suggest that patients with either an equally tensioned rectangular flexion space or with later-flexion lateral laxity after posterior cruciate ligament resection may achieve superior PROMs. Findings support the clinical benefit of facilitating posterolateral femoral roll back in flexion, which mimics native knee kinematics and further helps define targets for advanced technology.

SUMMARY:

- This study demonstrated that knees with equal or slightly increased laxity in the lateral compartment at 90 degrees of flexion report better PROMs compared to knees with more medial laxity. This adds additional support to the modern understanding of native knee kinematics, where femoral roll back occurs with greater displacement on the lateral side relative to the medial side supporting a medial-pivot kinematic pattern in flexion.
- This data supports the idea that equal or increased lateral laxity in deep flexion help drive femoral rollback, leading to a more normal feeling knee following a TKA

Access the full abstract and article through [The Journal American Academy of Orthopedic Surgeons 31 \(2023\) e834-e844.](#)

INTERNAL TIBIAL ROTATION DURING IN VIVO, DYNAMIC ACTIVITY INDUCES GREATER SLIDING OF TIBIO-FEMORAL JOINT CONTACT ON THE MEDIAL COMPARTMENT

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SOURCE:

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ABSTRACT:

Although extensive research has been conducted on rotational kinematics, the internal/ external rotation of the tibio-femoral joint is perhaps less important for protecting joint health than its effect on joint contact mechanics. The purpose of this study was to evaluate tibiofemoral joint contact paths during a functional activity (running) and investigate the relationship between these arthrokinematic measures and traditional kinematics (internal/external rotation). Tibio-femoral motion was assessed for the contralateral (uninjured) knees of 29 ACL-reconstructed individuals during downhill running, using dynamic stereo X-ray combined with three-dimensional CT bone models to produce knee kinematics and dynamic joint contact paths. The joint contact sliding length was estimated by comparing femoral and tibial contact paths. The difference in sliding length between compartments was compared to knee rotation. Sliding length was significantly larger on the medial side (10.2 ± 3.8 mm) than the lateral side (2.3 ± 4.0 mm). The difference in sliding length between compartments (mean 7.8 ± 3.0 mm) was significantly correlated with internal tibial rotation ($P < 0.01$, $R^2 = 0.74$). The relationship between rotational knee kinematics and joint contact paths was specifically revealed as greater tibial internal rotation was associated with larger magnitude of sliding motion in the medial compartment. **This could suggest that lateral pivot movement occurs during running.** Rotational kinematics abnormality should be treated for restoring normal balance of joint sliding between medial and lateral compartments and preventing future osteoarthritis.

SUMMARY:

- The data in this study failed to support the hypothesis that the knee pivots medially, but rather the results proved that the knee pivots laterally during running.
- Other studies that report medial pivot motion are limited by the study of cadavers instead of humans with excessively low muscle loads which fail to replicate functional activities.
- Traditional total knee arthroplasty implants that are designed to solely duplicate medial pivot movement may fail restore natural motion during demanding activities.

Access the full abstract and article through the [Knee Surgery Sports Traumatology Arthroscopy 20 \(2012\) 1268–1275.](#)

IN VIVO DEEP-FLEXION KINEMATICS IN PATIENTS WITH POSTERIOR-CRUCIATE RETAINING AND ANTERIOR-CRUCIATE SUBSTITUTING TOTAL KNEE ARTHROPLASTY

Y. Mikashima, T. Tomatsu, M. Horikoshi, T. Nakatani, S. Saito, S. Momohara, S.A. Banks

SOURCE:

Institute of Rheumatology, Tokyo Women's Medical University, Tokyo, Japan; Kishiwada City Hospital, Osaka, Japan; Department of Mechanical and Aerospace Engineering, & Department of Orthopaedics and Rehabilitation, University of Florida, Gainesville, FL, USA

ABSTRACT:

Posterior-cruciate ligament retaining total knee arthroplasty designs have long been used with excellent clinical success, but often have shown kinematics and flexion performance that are significantly different from the natural knee. The purpose of this study was to compare deep-flexion knee kinematics in patients with two types of posterior-cruciate ligament retaining total knee arthroplasty. One group received a traditional curved symmetric articular configuration, and one group received a design incorporating a lateral compartment which constrains the lateral condyle to the antero- posterior center of the tibial plateau in extension but allows translation in flexion – roughly approximating the role of the anterior cruciate ligament. In vivo kinematics were analyzed using three-dimensional model registration and plain radiographs of kneeling and squatting activities in 20 knees in 18 patients. Knees with the anterior cruciate ligament substituting design exhibited greater flexion, femoral antero-posterior translation and tibial internal rotation. **Geometric features intended to improve knee flexion, including greater antero-posterior stability, a more posterior tibial sulcus, and reshaped femoral condyles, do provide measurable and significant differences in deep-flexion knee kinematics.**

SUMMARY:

- Studies have shown that knee implant designs which restore more natural knee motion will manifest in superior clinical and functional results (Dennis, 1998; Banks 2003) and that ACL retaining knee replacements are preferred by patients (Pritchett, 2004).
- Enovis Surgical's 3D Knee™ recreates the function of the ACL through a laterally conforming tibial insert design. This conformity provides anteroposterior stability in extension yet allows posterior rollback in flexion.
- This study investigated the performance of the 3D Knee™ versus a traditional, symmetric cruciate retaining implant and demonstrated that the 3D Knee™ resulted in 10 degrees of increased flexion, increased lateral femoral rollback and increased tibial internal rotation, all of which support normal knee motion.

Access the full abstract and article through the [**Clinical Biomechanics 25 \(2010\) 83–87.**](#)

TIBIOFEMORAL KINEMATICS AND CONDYLAR MOTION DURING THE STANCE PHASE OF GAIT

Michal Kozanek, Ali Hosseini, Fang Liu, Samuel K. Vande Velde, Thomas J. Gill, Harry E. Rubash, Guoan Li

SOURCE:

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ABSTRACT:

Accurate knowledge of the dynamic knee motion in-vivo is instrumental for understanding normal and pathological function of the knee joint. However, interpreting motion of the knee joint during gait in other than the sagittal plane remains controversial. In this study, we utilized the dual fluoroscopic imaging technique to investigate the six-degree-of-freedom kinematics and condylar motion of the knee during the stance phase of treadmill gait in eight healthy volunteers at a speed of 0.67 m/s. We hypothesized that the 6DOF knee kinematics measured during gait will be different from those reported for non-weight-bearing activities, especially with regards to the phenomenon of femoral rollback. In addition, we hypothesized that motion of the medial femoral condyle in the transverse plane is greater than that of the lateral femoral condyle during the stance phase of treadmill gait. The rotational motion and the anterior-posterior translation of the femur with respect to the tibia showed a clear relationship with the flexion-extension path of the knee during the stance phase. Additionally, we observed that the phenomenon of femoral rollback was reversed, with the femur noted to move posteriorly with extension and anteriorly with flexion. **Furthermore, we noted that motion of the medial femoral condyle in the transverse plane was greater than that of the lateral femoral condyle during the stance phase of gait (17.4 +/- 2.0 mm vs. 7.4 +/- 6.1 mm respectively; $p < 0.01$). The trend was opposite to what has been observed during non-weightbearing flexion or single-leg lunge in previous studies.** These data provide baseline knowledge for the understanding of normal physiology and for the analysis of pathological function of the knee joint during walking. These findings further demonstrate that knee kinematics is activity-dependent and motion patterns of one activity (non-weight-bearing flexion or lunge) cannot be generalized to interpret a different one.

SUMMARY:

- The data in this study failed to support the hypothesis that the knee pivots medially, but rather the results proved that the knee pivots laterally during walking.
- This study reported lateral pivot knee motion through the measurement of increased anteroposterior translation of the medial femoral condyle relative to the lateral femoral condyle during walking.
- These findings demonstrate that knee kinematics are activity dependent and motion patterns of one activity, such as lunging, cannot be generalized to other activities such as walking.

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THE KNEE JOINT CENTER OF ROTATION IS PREDOMINANTLY ON THE LATERAL SIDE DURING NORMAL WALKING

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SOURCE:

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ABSTRACT:

The purpose of this study was to test the hypothesis of whether the center of rotation (COR) in the transverse plane of the knee is in the medial side during normal walking in a manner similar to that previously described during non-ambulatory activities. The kinematics for normal knees was obtained from 46 knees during normal walking using the point cluster technique. The COR of the medial-lateral axis of the femur relative to the tibia was determined during the stance phase of walking. The hypothesis that the COR is in the medial side during stance was not supported by this study. **The average COR during the stance phase of walking was in the lateral compartment for all 46 knees.** In addition, the instantaneous COR occurred on the medial side on average <25% of the time during the stance phase. Thus, while the COR is predominantly on the lateral side of the knee during walking, the normal function of the knee during walking is associated with both lateral and medial pivoting. **These results also demonstrate the importance of describing knee kinematics in the context of a specific activity or the constraints of the test conditions.**

SUMMARY:

- The study objective was to determine whether the center of rotation (COR) of the knee lies more frequently on the medial side or the lateral side of the knee during walking.
- The results of this study demonstrated that the instantaneous COR of the knee was predominantly lateral to the center of the tibia during the stance phase of walking.
- The author concludes that TKR implant designs should permit lateral pivoting motions during normal walking (the most frequent activity of daily living) while permitting the capacity for medial pivoting motions during non-ambulatory activities such as squatting.

Access the full abstract and article through the [Journal of Biomechanics 41 \(2008\) 1269–1273.](#)



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