Evidence in focus
Compendium of evidence

Summary of the current clinical evidence

February 2019

Smith & Nephew
Journey II TKA
Total Knee Arthroplasty
Supporting healthcare professionals
Evidence in focus
Compendium of evidence

JOURNEY™ II TKA

Click to view the evidence by subject of interest

- Recovery
- Function
- Patient Satisfaction
- Health Economics
- Survivorship

View all evidence
### Evidence in focus

**Compendium of evidence**

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### JOURNEY® II TKA

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**JOURNEY® II TKA**

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Second-generation bi-cruciate stabilized total knee system has a lower reoperation and revision rate than its predecessor


**Key results**

Compared to JOURNEY™ I BCS, JOURNEY II BCS is associated with:

- A lower risk of reoperation and revision

**Study citation**

Christen B, Kopjar B. Second-generation bi-cruciate stabilized total knee system has a lower reoperation and revision rate than its predecessor. *Arch Orthop Trauma Surg*. 2018;138:1591-1599.

Available at: [Archives of Orthopaedic and Trauma Surgery](https://www.smith-nephew.com)

Performance of second-generation guided motion total knee arthroplasty system

Harris AI, et al. AAHKS 2018 Annual Meeting (2018a)

**Key results**

Compared to AOANJRR registry data for cemented PS implants, JOURNEY II BCS demonstrated:

- A lower revision rate at 5 years, especially in patients <55 years old

**Study citation**

Harris AI, O’Grady C, Seneiba PR, et al. Performance of second-generation guided motion total knee arthroplasty system. Results from the international multicentre study of over 2,000 primary total knee arthroplasties with up to 6 years follow-up. Presented at: American Association of Hip and Knee Surgeons (AAHKS) 2018 Annual Meeting; November 1-4, 2018; Dallas, Texas, USA.
Short-term safety and effectiveness of a second generation motion-guided total knee system


Key results

At 24 months, JOURNEY™ II BCS showed:

- Significant improvements in objective (p<0.0001) and patient-reported outcomes (satisfaction, p<0.0001; patient expectation, p=0.039; functional activities, p<0.0001) compared to six months post-TKA
- A revision rate of 0.73 per 100 observed component years

![Figure 1. Mean objective KSS at 6, 12 and 24 months post-TKA with JOURNEY II BCS](image)

Study citation


Bi-cruciate substituting total knee arthroplasty provides varus-valgus stability throughout the midflexion range


Key results

In mid-flexion, JOURNEY II BCS showed:

- Significantly improved varus-valgus laxity compared to pre-TKA levels (p<0.05)

![Figure. Comparison of pre- and post-JOURNEY II BCS varus-valgus laxity through range of motion](image)

Study citation

The relationship between anteroposterior stability and medial-lateral stability of the bi-cruciate stabilized total knee arthroplasty\(^5\)


**Key results**

JOURNEY\(^{\text{TM}}\) II BCS demonstrated that:

- Anteroposterior stability has a positive relationship with intraoperative medial stability

![Anteroposterior translation was positively correlated with medial joint laxity at 30°](image1)

**Study citation**


The relationship between soft-tissue balance and intraoperative kinematics of guided motion total knee arthroplasty\(^6\)


**Key results**

JOURNEY II BCS showed:

- The appropriate soft tissue balance is an equal or larger flexion than extension gap of the medial compartment
- Tight flexion gaps should be avoided

![Appropriate soft tissue balance of the medial compartment of JOURNEY II BCS](image2)

**Study citation**

The influence of compressive forces across the patellofemoral joint on patient-reported outcome after bi-cruciate stabilized total knee arthroplasty


**Key results**

JOURNEY II BCS demonstrated:

- Reducing compressive forces at the patellofemoral joint at 60° and 140° of flexion may improve patient satisfaction, FJS-12 and patella score

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**Study citation**


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Minor adaptations in implant design bicruciate-substituted total knee system improve maximal flexion


**Key results**

JOURNEY II BCS demonstrated:

- Significantly higher median maximum flexion when compared to PS knees (130° vs 124°; p=0.04)
- Fewer adverse events than JOURNEY I BCS

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**Study citation**

Kosse NM, Heesterbeek PJc, Defoort KC, et al. Minor adaptations in implant design bicruciate-substituted total knee system improve maximal flexion. Poster presented at: 2nd World Arthroplasty Congress; 19-21 April, 2018; Rome, Italy.
Comparison of functional outcomes following total knee arthroplasty with a conventional implant design or one designed to mimic natural knee kinematics

Lutes W and Fitch D. SICOT Orthopaedic World Congress (2018)

Key results
Compared to conventional TKA, JOURNEY II CR patients reported:

- Significant improvements in functional outcomes from 3-month out to 2 years (p<0.05)

Study citation
Lutes W, Fitch D. Comparison of functional outcomes following total knee arthroplasty with a conventional implant design or one designed to mimic natural knee kinematics. Presented at: 39th SICOT Orthopaedic World Congress; October 10-13, 2018; Montréal, Canada.

Hospital related clinical and economic outcomes of a bicruciate knee system in total knee arthroplasty patients


Key results
Compared to other TKA knees, JOURNEY II BCS was associated with:

- Significant reductions in total hospital cost (p<0.0001) and hospital stay (p<0.0001)
- Patients receiving JOURNEY II BCS were also:
  - Less likely to be readmitted within 30 days readmission
  - More likely to be discharged to home
  - Less likely to be discharged to a skilled nursing facility

Study citation
Mayman DJ, Patel AR, Carroll KM. Hospital Related Clinical and Economic Outcomes of a Bicruciate Knee System in Total Knee Arthroplasty Patients. Poster presented at: ISFOR Symposium; May 19-23, 2018; Baltimore, Maryland, USA.
**Knee kinematics in bi-cruciate stabilized total knee arthroplasty during squatting and stair-climbing activities**


**Key results**

JOURNEY™ II BCS patients exhibited:

- Significantly improved functional KSS scores compared to pre-TKA (*p*<0.001)
- Sagittal plane physiological kinematics during squatting and stair-climbing

**Study citation**


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**In vivo kinematics of gait in posterior-stabilized and bicruciate-stabilized total knee arthroplasties using image-matching techniques**


**Key results**

JOURNEY II BCS demonstrated:

- Physiological knee kinematics, including double knee action and stable tibiofemoral AP translation
- A higher frequency of posterior cam-post contact than PS TKAs

**Study citation**

Preoperative tibial mechanical axis orientation and articular surface design influence on the coronal joint line orientation relative to the ground during gait after total knee arthroplasties


Key results

Compared to PS TKA, JOURNEY™ II BCS demonstrated:

- A significant reduction in the lateral tilt of the artificial joint line (p<0.0001)
- It can better accommodate the residual lateral tilt of the joint line due to the 3° medial inclination of the joint surfaces of the implant

Study citation


The bicruciate substituting knee design and initial experience

Nodzo SR, et al. Tech Orthop. 2018

Key results

Compared to PS TKA knees, JOURNEY II BCS showed:

- Significant improvements in postoperative knee ROM (p<0.0001)
- Significant improvements in KSS scores (p<0.001)

Study citation

A comparison of patient reported outcomes between total knee arthroplasty patients receiving the JOURNEY II Bi-Cruciate Stabilizing Knee System and total hip arthroplasty patients\textsuperscript{15}


**Key results**

JOURNEY\textsuperscript{®} II BCS patients reported:

- Significantly similar levels of satisfaction and patient-reported outcomes as total hip arthroplasty (THA) patients at three months and one year post-TKA

![Overall satisfaction for JOURNEY II BCS and THA patients at 1 year postop](image)

**Study citation**

Snyder MA, Sympson A, Gregg J, Levit A. A comparison of patient reported outcomes between total knee arthroplasty patients receiving the JOURNEY II bi-cruciate stabilizing knee system and total hip arthroplasty patients. Orthop Trauma Prosth. 2018.

Changes in total knee arthroplasty design affect in-vivo kinematics in a redesigned total knee system: a fluoroscopy study\textsuperscript{16}


**Key results**

JOURNEY II BCS resulted in:

- Modified in-vivo kinematic patterns compared to JOURNEY I BCS

![Patterns of anterior/posterior translation (% of the medial and lateral tibial component in terms of absolute placement in the three motor tasks (pooled) at different knee flexion degrees for JOURNEY II](image)

**Study citation**

In vivo kinematic comparison of a bicruciate stabilized total knee arthroplasty and the normal knee using fluoroscopy\textsuperscript{17}


**Key results**

JOURNEY\textsuperscript{™} II BCS exhibited:

- Normal-like kinematic patterns and moved as designed under in vivo observation
- Similarities in early and late kinematic patterns with normal asymptomatic knees

![Figure](image.png)

Figure. Medial and lateral anterior-posterior positions exhibited in JOURNEY II BCS and normal knee subjects during a deep knee bend (mm) [+Anterior, -Posterior]

**Study citation**


Available at: [The Journal of Arthroplasty](#)

Good early results obtained with a guided-motion implant for total knee arthroplasty: a consecutive case series\textsuperscript{18}


**Key results**

JOURNEY I and JOURNEY II BCS showed:

- Good early functional results
- An acceptable rate of complications

![Figure](image.png)

Figure. Percentage of patients with ITB friction syndrome

**Study citation**


Available at: [The Open Orthopaedics Journal](#)
A comparison of rollback ratio between bicruciate substituting total knee arthroplasty and Oxford unicompartmental knee arthroplasty


Key results
Compared to asymptomatic control knees and Oxford UKA knees, JOURNEY II BCS TKA showed:

- No significant difference in rollback ratio or knee flexion

Study citation

Comparison of intra-operative navigation-based kinematics between bi-cruciate-stabilised total knee arthroplasty (TKA) and conventional posterior-stabilised TKA


Key results
Compared to PS TKA, JOURNEY II BCS demonstrated:

- Significantly reduced amount of rotational changes in the tibia (p<0.05)

Study citation
### Bi-cruciate substituting total knee arthroplasty improved medio-lateral instability in mid-flexion range


**Key results**

JOURNEY™ II BCS TKA provided:

- A constant medial and lateral component gap allowing >120° range of motion, when medial tightness was less than 2mm
- Medio-lateral stability which allows for a normal pivot movement of the knee

**Study citation**


Available at: [Journal of Orthopaedics](https://www.smith-nephew.com)

### Does postoperative mechanical axis alignment have an effect on clinical outcome of primary total knee arthroplasty? A retrospective cohort study


**Key results**

JOURNEY™ II BCS demonstrated:

- Good functional outcomes in patients with neutral mechanical alignment, as well as those with post-TKA mild varus

**Study citation**


Available at: [The Open Orthopaedics Journal](https://www.smith-nephew.com)
Comparison of muscle recovery following bi-cruciate substituting versus posterior stabilized total knee arthroplasty in the Asian population


**Key results**

Compared to PS TKA, JOURNEY™ II BCS showed:

- Significantly increased ROM (p=0.002)
- No significant difference in muscle recovery at 3, 6, and 12 months post-TKA

![Figure](image1.png)

*Figure. Quadricep (solid line) and Hamstring (dotted line) muscle recovery (%) at 1, 3, 6, and 12 months post JOURNEY II BCS or PS TKA*

**Study citation**


Contact stress analysis of the anterior tibial post in bi-cruciate stabilized and mobile-bearing posterior stabilized total knee arthroplasty designs


**Key results**

JOURNEY II BCS showed:

- Stable contact conditions, with an anterior tibial post and femoral anterior cam construct to replicate the function of the ACL during extension of the knee

![Figure](image2.png)

*Figure. The contact stress on the anterior aspect of the tibial post of JOURNEY II was less than 10MPa (compressive yield stress of polyethylene) at all flexion angles*

**Study citation**

Gait analysis of conventional total knee arthroplasty and bicruciate stabilized total knee arthroplasty using a triaxial accelerometer


### Key results

Compared to conventional TKA, JOURNEY™ II BCS TKA resulted in:

- Less acceleration in the anteroposterior direction in the early swing phase, suggesting the knee joint was stabilized in the anteroposterior direction in the early flexion phase, reducing paradoxical motion.

### Study citation


Available at: [Case Reports in Orthopedics](https://www.dovepress.com/)

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**Figure.** The average voltage (V) on femoral or tibial side following conventional or JOURNEY II BCS TKA.
References

2. Harris AI, O’Grady C, Seneiba PR, et al. Performance of second-generation guided motion total knee arthroplasty system: Results from the international multicentre study of over 2,000 primary total knee arthroplasties with up to 6 years follow-up. Presented at: American Association of Hip and Knee Surgeons (AAHKSI) 2018 Annual Meeting; November 1-4, 2018; Dallas, Texas, USA.
9. Lutes W, Ritch D. Comparison of functional outcomes following total knee arthroplasty with a conventional implant design or one designed to mimic natural knee kinematics. Presented at: 39th SICOT Orthopaedic World Congress; October 10-13, 2018; Montréal, Canada.
10. Mayman DJ, Patel AR, Carroll KM. Hospital Related Clinical and Economic Outcomes of a Bicruciate Knee System in Total Knee Arthroplasty Patients. Poster presented at: ISFOR Symposium, May 19-23, 2018; Baltimore, Maryland, USA.
26. Kurosaka M. Bi-cruciate sparing/substituting total knee arthroplasty with up to 6 years follow-up. Presented at: American Association of Hip and Knee Surgeons (AAHKSI) 2018 Annual Meeting; November 1-4, 2018; Dallas, Texas, USA.
JOURNEY II BCS design results in reduced rate of revision and reoperation when compared with JOURNEY I BCS

Overall cumulative revision rate for JOURNEY II BCS of 1.89 per 100 total knee arthroplasties (TKA) at approximately four years compared to 9.68 per 100 TKAs for JOURNEY I BCS

Study overview

- Retrospective review of all consecutive TKAs using JOURNEY I or JOURNEY II BCS at a single-surgeon centre to assess early complication and revision rates
  - JOURNEY I: 155 consecutive TKAs (patients, 138; mean age, 66.7 years; females, 80; mean follow-up, 6.23 years)
  - JOURNEY II: 140 consecutive TKAs (patients, 131; mean age, 65.0 years; females, 80; mean follow-up, 1.86 years)
- Outcomes were revision and reoperation rates

Key results

- TKA with any (one or more) reoperations (Figure):
  - JOURNEY I: 22 (2.28 per 100 observed component years [OCY])
  - JOURNEY II: 4 (1.54 per 100 OCY)
  - Relative hazard for reoperation: 3.5 times higher for JOURNEY I than JOURNEY II TKAs (p=0.0258)

- TKA with any (one or more) revisions (Figure):
  - JOURNEY I: 16 (1.66 per 100 OCY) (infection, 4; instability, 4; peri-prosthetic fracture, 3; aseptic loosening, 1; iliotibial band friction syndrome, 1; dislocation, 2; pain, 1)
  - JOURNEY II: 2 (0.77 per 100 OCY) (trauma-related peri-prosthetic femoral fracture, 1; patellar fracture and necrosis in resurfaced patellar, 1)
  - Relative hazard for revision: 4.16 times higher for JOURNEY I than JOURNEY II TKAs (p=0.0693)

Conclusion

This retrospective study shows that JOURNEY II has a low and acceptable risk of revision. The design modifications to approximate normal knee kinematics applied to JOURNEY II appear to be associated with a reduction in the revision and reoperation rate observed with JOURNEY I.

Considerations

- The compared cohorts did not begin concurrently
- The JOURNEY I cohort had a longer follow-up than the JOURNEY II cohort

Study citation


Available at: Archives of Orthopaedic and Trauma Surgery
JOURNEY™ II BCS total knee arthroplasty (TKA) shows favourable mid-term revision rates compared with reported registry cemented posterior stabilised (PS) implants

With approximately 1% of JOURNEY II BCS patients requiring major revision at 6 years
JOURNEY™ II BCS shows positive outcomes in objective Knee Society Scores (KSS)

Few complications and a low incidence of revision reported at 24 months

Study design

- A multicentre case series assessing the short-term safety and effectiveness of JOURNEY II BCS total knee arthroplasty (TKA)
  - 186 patients enrolled (209 knees; mean age, 61.1 years)
  - Objective KSS, radiographic assessment and treatment complication data were collected at 6, 12 and 24 months post-TKA

Key results

- The mean objective KSS was significantly increased at 24 months compared with six months post-TKA (Figure)
- The mean length of hospital stay was 2.7 days (range, 1–15 days)
- Low incidence of revision (three knees) and no revisions reported due to tibial or femoral components
- Revision rate: 0.73 per 100 observed component years
- Low number of complications reported:
  - Ten TKAs (seven patients) treated with closed manipulation for stiffness; two TKAs with reported iliotibial band syndrome; two deep infections (one required surgery); no dislocations

Conclusion

JOURNEY II BCS is a safe and effective device, demonstrating significant improvements in objective KSS by 24 months post-TKA.

Considerations

- Owing to the retrospective enrollment of subjects, baseline KSS scores were not available

Study citation

Significant improvements in patient-reported Knee Society Scores (KSS) seen with JOURNEY™ II BCS

More than 90% of patients returned to work within six months of surgery

Study design

- A US multicentre case series assessing short-term patient-reported outcomes following JOURNEY II BCS total knee arthroplasty (TKA)
  - 186 patients were enrolled at six months post-TKA (209 knees; mean age, 61.1 years)
  - Patient pain relief, functional abilities and fulfillment of expectation (as measured by KSS) data were collected at 6, 12 and 24 months post-TKA

Key results

- Significant improvements were noted from six to 24 months patient-reported outcomes:
  - Satisfaction (32.7 to 35.2; p < 0.0001)
  - Patient expectation (10.4 vs 10.9; p = 0.039)
  - Functional activities (75.4 vs 81.5; p < 0.0001)
- Low pain scores were reported at 24 months post-TKA (0–10 pain scale)
  - Pain with level walking: 0.79
  - Pain with stair or incline: 1.50
- Over 90% of patients had returned to work by the six-month follow-up (Figure)

Conclusion

JOURNEY II BCS showed significant improvements in patient-reported KSS and movement-associated pain at 24 months post-TKA.

Considerations

- Owing to the retrospective enrollment of subjects, baseline KSS scores were not available

Study citation

Lower intraoperative compressive forces at the patellofemoral joint (PFJ) in JOURNEY® II BCS patients are associated with improved patient satisfaction

No anterior knee pain was observed following TKA with JOURNEY II BCS

Study overview

- Single-surgeon, prospective study of 42 patients (female, 36; male, 6; mean age, 72.3 years) with varus-type osteoarthritis who underwent total knee arthroplasty (TKA) with JOURNEY II BCS
- Compressive forces across the PFJ were measured intraoperatively at 10°, 30°, 60°, 90°, 120° and 140° of flexion
- Range of motion (ROM), Knee Society Knee Score (KSS-Knee), Knee Society Function Score (KSS-Function), patella score and Forgotten Joint Score 12 (FJS-12) were recorded two years post TKA

Key results

- Low PFJ compressive forces at 140° of flexion were associated with high patient satisfaction scores ($R^2=0.458; p=0.041$; Figure) and high FJS-12 scores ($R^2=0.378; p=0.036$)
- Low PFJ compressive forces at 60° of flexion were associated with high patella scores ($R^2=0.417; p=0.046$)
- No association between PFJ compressive forces and anterior knee pain
- Mean KSS-Knee (94 versus 31; $p<0.01$), KSS-Function (78 versus 55; $p<0.01$) and ROM (flexion [126 versus 119°; $p<0.01$] and extension [0 vs -6°; $p<0.01$]) were significantly improved at final follow-up compared to pre TKA
  - Twenty-three knees had flexion of 140°
- No patients had anterior knee pain

Conclusion

Reducing compressive forces at the PFJ at 60° and 140° of flexion may improve patient satisfaction, FJS-12 and patella score. The kinematics of medial-pivot designs, such as JOURNEY II BCS, have previously been shown to reduce PFJ compressive forces more effectively than posterior stabilised (PS) TKAs (Carpenter RD, et al1), and may offer improved patient satisfaction compared to PS TKAs. No patients reported anterior knee pain following TKA with JOURNEY II BCS.

Study citation

Available at: The Bone and Joint Journal

JOURNEY II BCS is designed to facilitate near-normal kinematics, positively impacting on patients’ satisfaction

Key results

- JOURNEY II BCS is designed to approximate normal-like knee kinematics
- Different implant designs are associated with different kinematic patterns
- Normal-like kinematic patterns result in better patient-reported outcomes

Patient dissatisfaction following total knee arthroplasty (TKA) is driven by a range of factors including knee function. Given that 52% of patients report some degree of limitation to their functional activities, this is clearly an area for improvement. The design of JOURNEY II BCS aims to restore the normal, healthy knee through its asymmetrical bearing geometry and a cam-post mechanism, which replaces both the anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL).

Data presented at Congress 2018:

How close to normal motion does JOURNEY II BCS get?

Designed to achieve normal-like kinematics through full range of motion

Typically, TKA results in less femoral rollback and axial rotation than in the normal knee, which may contribute to patient dissatisfaction.

“wide range of motion with an associated pronounced femoral rollback upon flexion”

New results from a multi-centre study of 20 patients show that the design of JOURNEY II BCS facilitates activity dependent knee kinematics with pronounced femoral rollback upon flexion. A more posterior position and later post-cam engagement were associated with closed chain chair raising activities than open chain flexion-extension activities. In addition, paradoxical anterior sliding was not shown during any activities with JOURNEY II BCS.

Similar results were seen in a study of 40 patients with JOURNEY II BCS who were compared with 10 normal, asymptomatic knees during weight bearing motion. Patients receiving JOURNEY II BCS implants experienced normal-like kinematic patterns during early and late flexion, demonstrating adequate ACL and PCL replication (Figure).

Kinematics calculated at 30° increments from full extension to 120°

<table>
<thead>
<tr>
<th>Key</th>
<th>30°</th>
<th>60°</th>
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Normal knee (n=10)

JOURNEY II BCS (n=40)

Figure. Medial and lateral anterior-posterior positions exhibited in JOURNEY II BCS and normal knee subjects during a deep knee bend (mm) (+Anterior, -Posterior)

Designed to achieve maximal flexion

Achieving sufficient range of knee flexion after TKA is essential to perform activities of daily living. Building on results from a previous randomised controlled trial comparing 62 patients with JOURNEY I BCS to 62 conventional posterior-stabilised knees, Kosse et al. studied a further 62 patients with JOURNEY II BCS to examine the maximal flexion and clinical impact of the new implant. The BCS II design maintains pre-operative maximal knee flexion, with a median maximal flexion of 130°, which is 6° more than conventional posterior-stabilised TKAs (p=0.04). These results indicate that JOURNEY II BCS has increased maximal flexion which better replicates normal knee motion.

“pre-operative maximal flexion is maintained after TKA with the BCS-II”
Does implant design impact on kinematic patterns?

A comparative study of three TKAs – JOURNEY II BCS, Unity™ (Corin, UK) and Persona™ (Zimmer Biomet, US) – investigated the effects of implant design and activity on tibiofemoral kinematics. The Unity TKA was associated with significantly more posterior tibiofemoral position, whilst JOURNEY II BCS showed significant external femoral rotation upon flexion. All three TKAs demonstrated limited paradoxical anterior sliding early flexion, which was most pronounced by the Persona TKA. Flexion angle at engagement of the post-cam mechanism was relatively early for Unity (50-60° flexion) and later for both JOURNEY II (50-80°) and Persona (70-90°). There was a difference between open and closed chain activities, with open chain activities associated with lower engagement angles. Although all three TKA implants demonstrate ACL and PCL function by the cam-post mechanism, it is apparent that differences in individual designs have effects on the kinematics and post-cam engagement during activity.

“individual [TKA] design significantly affects the tibiofemoral kinematics and timing of post-cam engagement”

Can implant design impact patient satisfaction?

Van Onsem et al have demonstrated for the first time a relationship between kinematic patterns of TKA and patient satisfaction. Kinematic patterns for three activities of daily living were analysed for JOURNEY II BCS and two posterior-stabilised TKAs. The results showed that poor patient-reported outcomes were associated with a pronounced paradoxical anterior motion on the medial side, less stable medial compartment in mid-flexion and less posterior translation in deep flexion on the lateral side.

“By evaluating and improving the factors that result in this aberrant kinematic pattern, one could increase the level of patient satisfaction after total knee arthroplasty”

Understanding TKA knee kinematics and their relationship to patient satisfaction is important for the design of implants that aim to restore normal knee function. JOURNEY II BCS has limited paradoxical anterior sliding, as well as post-cam engagement after 50° flexion which corresponds to posterior translation allowing for native knee roll back.

Conclusion

It is apparent that post-TKA knee kinematics greatly impact patient outcomes. The goal of TKA should be returning patients close to normal, which includes returning normal kinematic knee patterns during patient activity. Although different implant designs may replicate ACL-PCL function, it is important to understand that each individual design is associated with different kinematic patterns. The kinematic patterns observed in this study are however based on limited data; additional studies with larger sample sizes and longer follow-up periods are required to determine if these initial observations are consistent over time. Current evidence suggests that JOURNEY II BCS may be able to restore normal-like knee motion more than other posterior-stabilised implants.

References

5. Kosse NM, Heesterbeek PJC, Debrodt KC, Wymenga AB, van Heijlendorn GD. Improved maximal flexion after minor adaptations in implant design bicruciate-substituted total knee arthroplasty. Poster presented at 19th Congress of the European Federation of National Associations of Orthopaedics and Traumatology (EFORT); May 30 - June 1 2018; Barcelona, Spain.
JOURNEY® II Cruciate Retaining (CR) Knee System demonstrates significantly improved functional outcomes compared to conventional CR total knee arthroplasty (TKA)

These improvements may be attributable to the design of the JOURNEY II CR knee, which is designed to more closely replicate normal knee kinematics

Study overview

- Retrospective comparison of functional outcomes following JOURNEY II CR or conventional CR TKA carried out by a single surgeon between September 2012 and June 2014
  - JOURNEY II CR: 52 patients (mean age, 67.3 years)
  - Conventional TKA: 60 patients (mean age, 70.2 years)
- Knee society scores (KSS) and Western Ontario and McMaster Universities Arthritis Index (WOMAC) scores were assessed and compared pre TKA and at 3, 6, 12 and 24 months post TKA
- Range of motion (ROM) was assessed and compared pre TKA and at 3, 6 and 12 months post TKA

Key results

- JOURNEY II CR patients reported significantly improved KSS scores compared to conventional CR TKA at 3 (69.5 vs 63.0; p=0.016), 6 (84.4 vs 70.1; p=0.0343), 12 (93.0 vs 86.1; p<0.001) and 24 (96.4 vs 91.7; p<0.001) months post TKA (Figure 1)
- JOURNEY II CR patients reported significantly improved WOMAC scores compared to conventional CR TKA at 6 (17.8 vs 24.6; p=0.018) and 12 (12.4 vs 18.5; p=0.008) months post TKA, differences at other time points were not significant
- JOURNEY II CR patients had a significantly greater change in ROM from baseline compared to conventional CR TKA at 3 (-4.4 vs -10.1; p<0.05), 6 (5.8 vs -1.8; p<0.05) and 12 (11.4 vs 4; p<0.05) months post TKA (Figure 2)

Conclusion

JOURNEY II CR demonstrated significant improvements in short-term functional outcomes compared to conventional CR TKA. The results of this study suggest that choosing a knee implant designed to more closely replicate normal knee kinematics may improve patient-reported outcomes, and in turn patient satisfaction, compared to conventional TKA.

Study citation

*Lutes W and Fitch D. Comparison of functional outcomes following total knee arthroplasty with a conventional implant design or one designed to mimic natural knee kinematics. Presented at: 39th SICOT Orthopaedic World Congress; October 10-13, 2018, Montreal, Canada.
JOURNEY II BCS associated with significantly reduced total hospital cost, less likely to have 30 days readmission and significantly reduced hospital stays compared with other total knee arthroplasty (TKA) systems

A retrospective analysis of a real-world database also noted JOURNEY II BCS patients have higher odds of being discharged to home and lower odds of being discharged to a skilled nursing facility.

### Study design

- A retrospective cohort study from the Premier Perspective Database (2014 to 2016) compared patients with osteoarthritis undergoing primary TKA with JOURNEY II BCS (1,692 patients; mean age, 64.1 years) or other TKA devices (1,692 patients; mean age, 63.9 years).
- Hospital-related clinical and economic outcomes (reported as 2016 US dollars) were compared between the groups; 1:1 propensity score matching was used to control patients and provider characteristics.

### Key results

- Compared with patients receiving other TKA devices, those receiving JOURNEY II BCS:
  - Experienced significantly reduced mean patient hospital costs ($16,187 vs $17,877; p < 0.0001; Figure 1).
  - Were 51% less likely to be readmitted to hospital within 30 days (p = 0.0037; Figure 2; calculated value).
  - Were 35% more likely to be discharged to home (p = 0.0008; calculated value).
  - Were 41% less likely to be discharged to a skilled nursing facility (p < 0.0001; calculated value).
  - Experienced significantly reduced mean length of hospital stay (2.45 days vs 2.66 days; p < 0.0001).

### Conclusion

JOURNEY II BCS led to significant reductions in total hospital cost, less likely to have 30 days readmission and significant reductions in hospital stay. Patients receiving this device were also more likely to be discharged to home and less likely to be discharged to a skilled nursing facility when compared with patients undergoing primary TKA with other posterior-stabilized devices. Real-world data on cost and outcomes can help hospitals and healthcare professionals make informed decisions when choosing the best knee implant for their patients.

### Considerations

- This is an observational study, unmeasured confounders were not evaluated.

### Study citation

*Mayman DJ, Patel AR, Carroll KM. Hospital Related Clinical and Economic Outcomes of a Bicruciate Knee System in Total Knee Arthroplasty Patients. Poster presented at: ISPOR Symposium; May 19-23, 2018; Baltimore, Maryland, USA.
JOURNEY® II BCS is associated with significantly improved flexion and patient-reported outcomes compared with posterior-stabilized (PS) total knee arthroplasty (TKA)

JOURNEY II BCS demonstrated 23° more flexion than PS TKA at 1 year follow up

Study design
- A retrospective analysis of 200 patients (mean age, 51 years; males, 87; females, 113) who underwent primary TKA by a single surgeon, 2013-2014
  - Computer-navigated guides were used to minimize surgical alignment error
  - First 100 patients received JOURNEY II BCS
  - Next 100 patients received standard PS TKA
- Range of motion (ROM) and Knee Society Scores (KSS) were recorded pre-TKA and post-TKA (6 weeks and 1 year)

Key results
- Compared with patients receiving standard PS TKA, patients with JOURNEY II BCS showed:
  - Significantly improved mean ROM at 1 year post-TKA (119° vs 96°; p < 0.0001; Figure 1)
  - Significantly improved mean KSS scores at 1 year post-TKA (89 vs 81; p < 0.001; Figure 2)

Conclusion
JOURNEY II BCS led to significant improvements in ROM and patient-reported outcomes at 1 year post-TKA, compared with standard PS TKA. The results suggest that the more anatomic design of the implant, which is intended to replicate a more normal knee position and kinematic patterns, may be responsible for the improved flexion and patient satisfaction, compared with PS TKA.

Study citation
JOURNEY® II BCS total knee arthroplasty (TKA) patients experience comparable levels of satisfaction and activity to total hip arthroplasty (THA) patients in short-term follow-up

JOURNEY II BCS patients demonstrate substantial clinical improvements in pain and joint function at 1 year post-TKA

Study overview

- Retrospective review of data from a total joint registry in Cincinnati, Ohio, comparing patient outcomes between clinically matched JOURNEY II BCS TKA and THA patients
  - 48 JOURNEY II BCS patients (mean age, 58.3 years; male, 54.2%)
  - 48 THA patients (mean age, 55.9 years; male, 64.6%)
- Overall patient satisfaction, University of California and Los Angeles (UCLA) activity scores and EuroQol five-dimension scores (EQ-5D) were compared at 3 months and 1 year postoperatively (postop)

Key results

- No significant difference between JOURNEY II BCS TKA and THA in overall satisfaction at 3 months postop \( (p=0.398) \) or 1 year postop \( (p=0.590; \text{Figure 1}) \)
- JOURNEY II BCS patients reported significantly improved UCLA activity scores at 3 months (median UCLA score, 8 vs 7; \( p=0.028 \)) and 1 year (median UCLA score, 8 vs 7; \( p<0.001 \)) postop compared to THA patients
- JOURNEY II BCS patients reported significantly improved EQ-5D scores at 3 months (median EQ-5D score, 90 vs 80; \( p<0.001 \)), but there was no significant difference at 1 year postop \( (p=0.183) \) compared to THA patients
- No significant difference between JOURNEY II BCS TKA and THA in patient quality of life measures
  - Time to return to work, activities of daily living or sports activities at 3 months and 1 year postop
- JOURNEY II BCS patients showed a substantial clinical improvement over time in pain and joint function
  - 43.8% patients scored \( \geq 95 \) on the Knee Society (KS) pain score at 3 months post-op, which increased to 91.7% at 1 year postop
  - 37.5% patients scored \( \geq 90 \) on the KS function score at 3 months post-op, which increased to 95.8% at 1 year postop
  - Similar improvements were reported for patients with THA, measured using the Harris Hip Score
Evidence in focus (continued)

Conclusion

JOURNEY II™ BCS TKA patients report statistically similar levels of satisfaction and patient reported outcomes as THA patients at 3 months and 1 year postop. The kinematic design advancements of JOURNEY II BCS demonstrate improvements in patient satisfaction following TKA compared to past TKA procedures, via comparison with THAs.

Considerations

• The results of this study challenge the belief that patient satisfaction and activity are better for THA patients than for TKA patients
• Further studies are required to investigate whether knee implant design may be able to influence patient satisfaction

Study citation

*Snyder MA, Sympson A, Gregg J, Levit A. A comparison of patient reported outcomes between total knee arthroplasty patients receiving the JOURNEY II bi-cruciate stabilizing knee system and total hip arthroplasty patients. Orthop Trauma Prosth. 2018; http://doi.org/10.15674.0030-5987201835. Available at: Orthopaedics, Traumatology and Prosthetics
Changes to implant design result in modification of observed kinematic patterns for JOURNEY® II Bi-Cruciate Stabilized (BCS)

Design modifications effectually adjust femoral translation and rollback

Study overview
- A single-centre case series assessing differences in knee kinematics between JOURNEY BCS and JOURNEY II BCS implants
  - Group A: 16 patients with JOURNEY II BCS (males, 3; females, 13; mean age, 69.3 years)
    - Fluoroscopic examination at follow-up (mean 8 months, range 3-13 months) during closed chain activity (stair climbing, chair rising) and open chain activity (leg extension)
    - Range of motion (ROM) and international knee society (IKS) score recorded pre-TKA and at follow-up (mean 8 months, range 3-13 months)
  - Group B: data from patients with JOURNEY BCS who underwent the same investigations (Catani et al, 2009)

Key results
- In line with the intentions of the modified design, statistically significant differences in kinematics between Group A and B were observed
  - Group A showed reduced femoral external rotation during flexion; reduced anterior-posterior translation; a more neutral position in full extension compared to Group B
  - Group B demonstrated consistently posteriorly directed kinematic patterns in both compartments suggesting significant posterior-femoral rollback
  - By comparison, Group A showed a relatively constant medial contact point across the central part of the tibial base plate; a posterior displacement of the lateral contact point in the first 20° of flexion; a small anterior translation in the central region of knee flexion; a slight posterior translation after 60-65° flexion (Figure)
  - Both groups demonstrated similar kinematic patterns of axial rotation with progressive femoral external rotation with knee flexion
  - No significant differences in pre-/post-TKA ROM or post-TKA IKS between Group A and B
  - No cases of iliotibial band friction syndrome were recorded

Conclusion
The design changes implemented to reduce posterior displacement of the femoral condyles and femoral component rotation in weight bearing conditions result in the modified in-vivo kinematic patterns observed in JOURNEY II BCS.

Considerations
- This study includes an indirect comparison of the results to those of Catani et al

Study citation
Available at: Clinical Biomechanics

JOURNEY® II BCS exhibits normal-like knee kinematic patterns

Dual cam-post design effectively compensates for bicruciate ligament function

**Study design**
A retrospective, comparative, single-surgeon analysing the in vivo kinematics of 50 knees through a full weight-bearing range of motion:
- 40 implanted with JOURNEY II BCS (mean age, 69.8 years ± 8.3 years)
- 10 normal asymptomatic knees (mean age, 57.4 years ± 7.2 years)

**Key results**
- **0-30°**: JOURNEY II BCS subjects exhibited similar patterns of femoral rollback and axial rotation compared with normal knee subjects
- **30-60°**: JOURNEY II BCS subjects experienced minimal anterior-posterior motions and axial rotation, whereas normal knees continued to rollback and externally rotate
- **60-90°**: JOURNEY II BCS resumed posterior motion
- **After 90°**: axial rotation increased in a normal-like fashion

**Conclusion**
- JOURNEY II BCS exhibits normal-like kinematic patterns and moves as designed under in vivo observation
- Similarities in early and late kinematic patterns between the two groups suggest the dual cam-post design and asymmetric articular geometries of the JOURNEY II BCS adequately replicate ACL and PCL function
- Cruciate ligament function cannot be truly replicated during mid-flexion, because neither cam-post is engaged

**Study citation**
Study design
A single-surgeon retrospective case series comparing short-term results with the JOURNEY BCS (BCS I) and JOURNEY II BCS (BCS II):
• BCS I: 153 patients (mean age, 69.2 years) followed for 28 months
• BCS II: 104 patients (mean age, 68.5 years) followed for 15 months

Key results
Positive clinical outcomes with BCS II at one-year follow-up:
• Significant improvements over baseline in Knee Score, Function Score and range of motion (ROM)
• Average postoperative scores: Knee Score, 91; Function Score, 88; ROM, 127°
Limited complications with BCS II:
• No stiffness (defined as: flexion < 90°)
• Little or no clinically meaningful iliotibial band (ITB) friction syndrome

Conclusion
Good early functional results and an acceptably low rate of complications were obtained with the BCS II and the earlier-generation BCS I.

Considerations
• A proper comparison between BCS I and BCS II was not possible, due to differences in follow-up times and patient demographics

Study citation
JOURNEY® II BCS restores function comparable to bicruciate retaining Oxford Unicompartmental Knees (UKA)

The bicruciate stabilising design reproduces anterior and posterior cruciate ligament function and native knee rollback

**Study design**

A single-surgeon retrospective study comparing outcomes at 6–9 months follow-up of patients treated with:

- **JOURNEY II BCS:** n=64 patients (mean age, 71.3 years ± 7.2 years)
- **UKA:** n=50 patients (mean age, 73.8 years ± 6 years)
- **Control group:** contralateral asymptomatic knees of subjects with UKA

**Key results**

Post-operative lateral knee radiograph (full flexion) showed:

- No significant difference in rollback ratio or knee flexion angle among the three groups (Table 1)
- Significant correlation between rollback ratio and knee flexion angle among the three groups (p=0.002) (Table 1)

<table>
<thead>
<tr>
<th></th>
<th>JOURNEY II BCS</th>
<th>UKA</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rollback ratio %, mean (standard deviation)</td>
<td>37.9 (± 4.9)</td>
<td>35.7 (± 4.2)</td>
<td>35.3 (± 4.8)</td>
</tr>
<tr>
<td>Flexion angle degrees, mean (standard deviation)</td>
<td>123.8 (± 8.4)</td>
<td>125.4 (± 7.5)</td>
<td>127 ± (10.3)</td>
</tr>
</tbody>
</table>

Table 1. Rollback ratio and flexion angle measurement

**Conclusion**

- **JOURNEY II BCS** showed no significant difference in rollback ratio when compared with UKA or asymptomatic control knees.
- The implant design is likely to reproduce native anterior and posterior cruciate function and native knee rollback.

**Considerations**

- Pre-operative evaluation of rollback ratio and knee flexion was not performed

**Study citation**

JOURNEY® II BCS demonstrates mid-flexion medio-lateral (ML) stability

Improved ML stability is associated with high patient satisfaction

**Study design**
- A single-centre case series assessing ML stability throughout full range of motion (ROM) following JOURNEY II BCS total knee arthroplasty (TKA)
- 39 knees (33 patients; mean age, 78; male, 8; female, 31)
- A specifically developed tensor device was used intraoperatively to measure:
  - Medial and lateral component gaps, ML stability and medial tightness at 0°, 30°, 60°, 90° and 120° of flexion
- Associations between intraoperative ML stability and clinical results were recorded at 2 years post-TKA

**Key results**
Medial and lateral component gaps
- Were consistent through full ROM
- No mid-flexion instability observed at 30°, 60°, 90° of flexion
  - Increased flexion was associated with:
    - Smaller medial component gaps (p<0.001)
    - Smaller ML component gaps (greater ML stability) (p<0.002)
    - Medial tightness ≤2mm
  - Mid-flexion stability was associated with high patient satisfaction (p<0.002)

**Conclusion**
JOURNEY II BCS provides a consistent medial and lateral component gap throughout range of motion and allows the patient to achieve >120° flexion when medial tightness is 2mm or less. No medial release was required to equalise the medial component gap with the lateral.

JOURNEY II BCS provides ML stability which allows for a normal-like medial pivot movement of the knee. This may positively impact patient satisfaction.

**Considerations**
Only patients with medial knee osteoarthritis were considered in this study, therefore the results cannot be generalized to other conditions.

**Study citation**
Available at: J Orthop [link]

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