Rediscover Normal

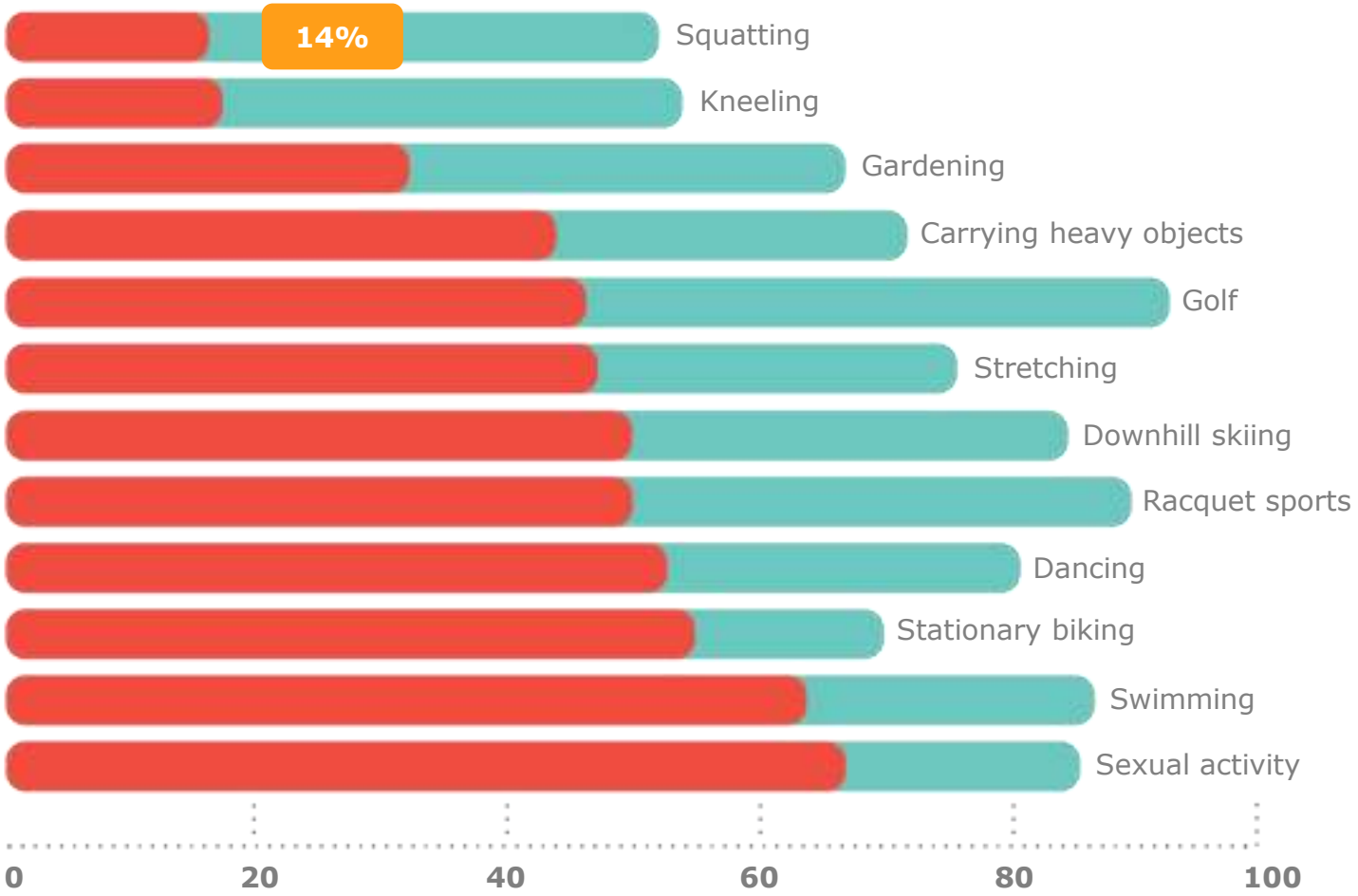
JOURNEY◇ II TKA

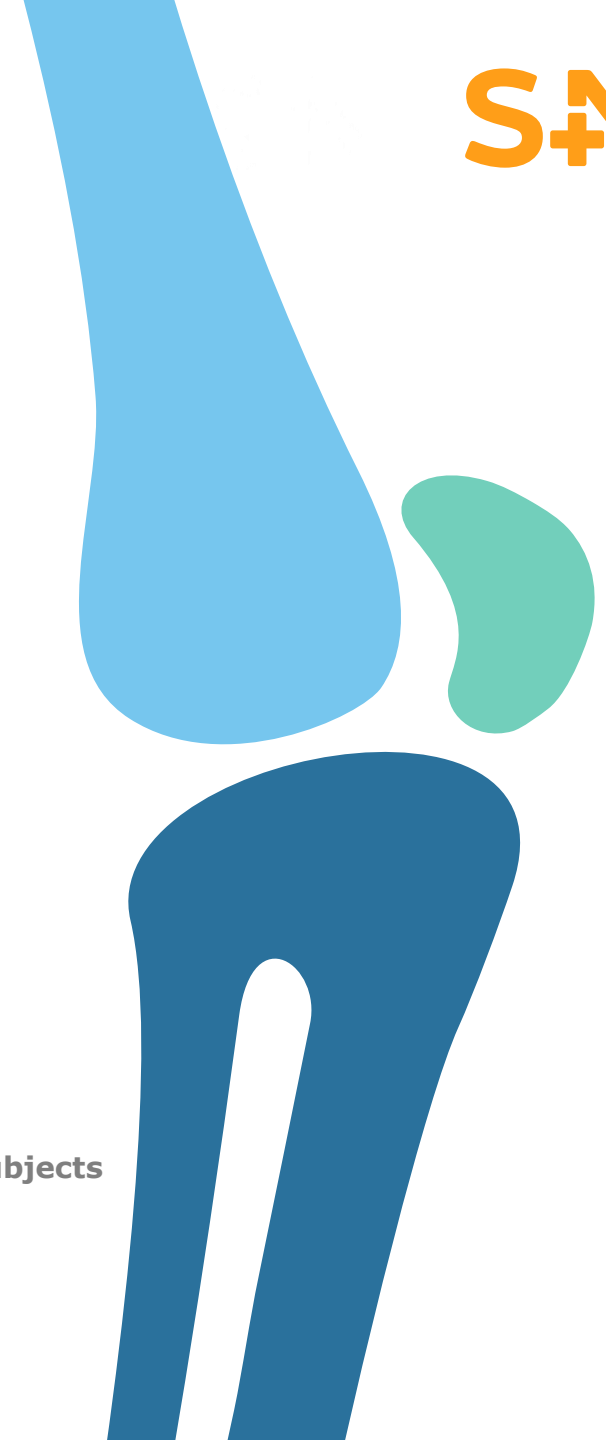
Nathan Parrish

Patient satisfaction

15-20% of knee patients are not satisfied[1-2]

Noble et al. Percent reporting no difficulty[3]





1. Scott CE, et al. J Bone Joint Surg Br. 2010;92-B(9):1253-1258.
2. Bourne RB, et al. Clin Orthop Relat Res. 2010;468:57-63.
3. Noble PC, et al. Clin Orthop Relat Res. 2005;431:157-165

The design of total knee implants causes changes in the motion and “feel” of the knee. This change can have a negative impact on patient satisfaction and performance.[1-4]

1. Collins M, et al. Orthop Traumatol Surg Res. 2012;98:275–280.
2. Dennis D, et al. Clin Orthop Relat Res. 2004;428:180-189.
3. Van Onsem S, et al. Clin Orthop Relat Res. 2020;478:255-263.
4. Parcells BW, et al. Am J Orthop. 2016;45:153–160.

Normal Knee Kinematics

0° (Full Extension)

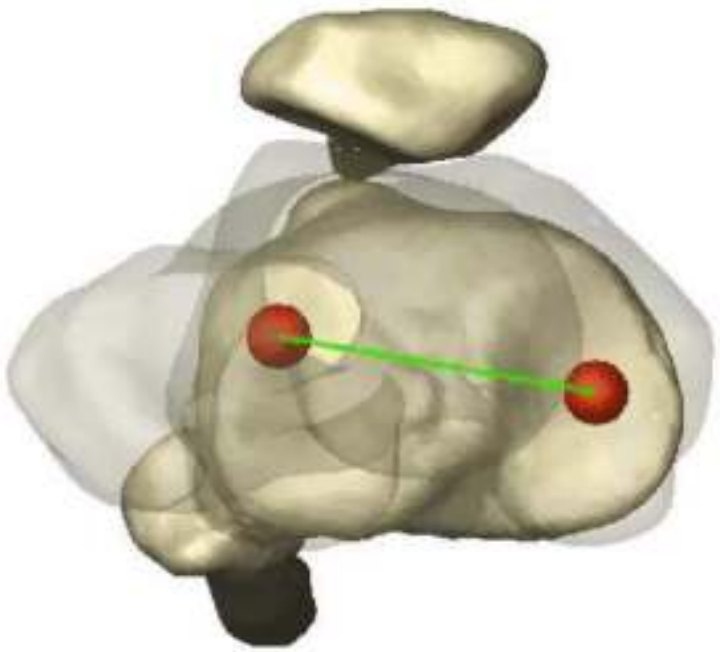
- Screw-home (5° femoral internal axial rotation)
- No posterior femoral overhang
- Results in stance efficiency

1-90° (Mid Flexion)

- Medial pivot
- Lateral posterior translation (Q angle ~0°)
- Results in increased quad efficiency

90-155° (Full Flexion)

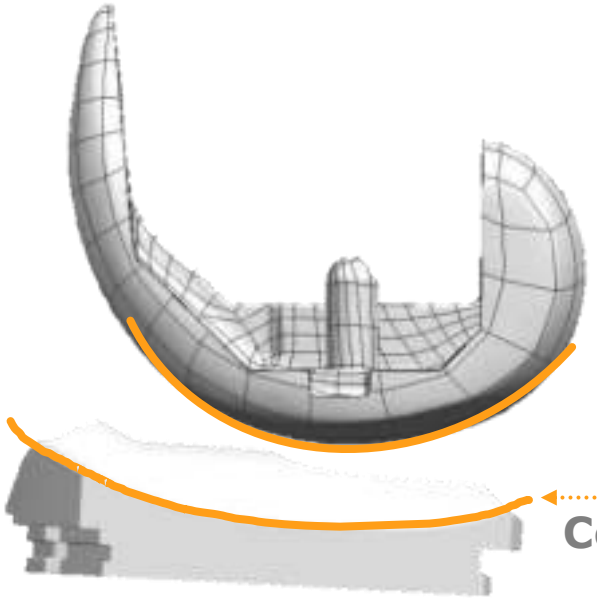
- Posterior femoral translation
- Axial rotation retained
- Translation aids in deep flexion and quad efficiency

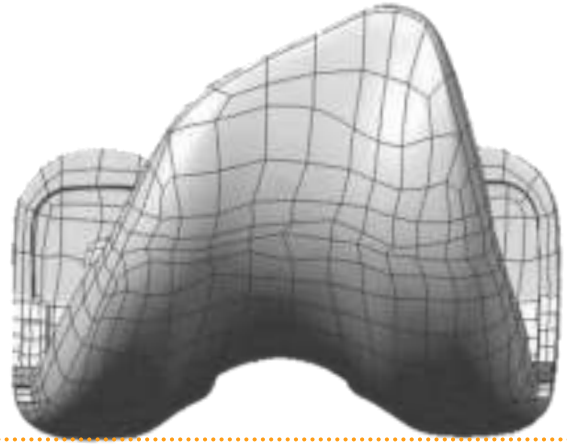


Grieco TF, et al. *J Arthroplasty*. 2018;33(2):565-571.

Implant Design changes Kinematics

Conventional Shapes/Positions

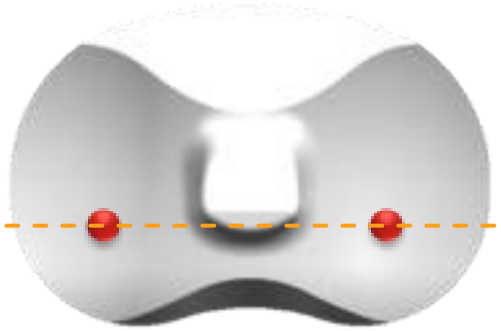




Symmetric joint-line

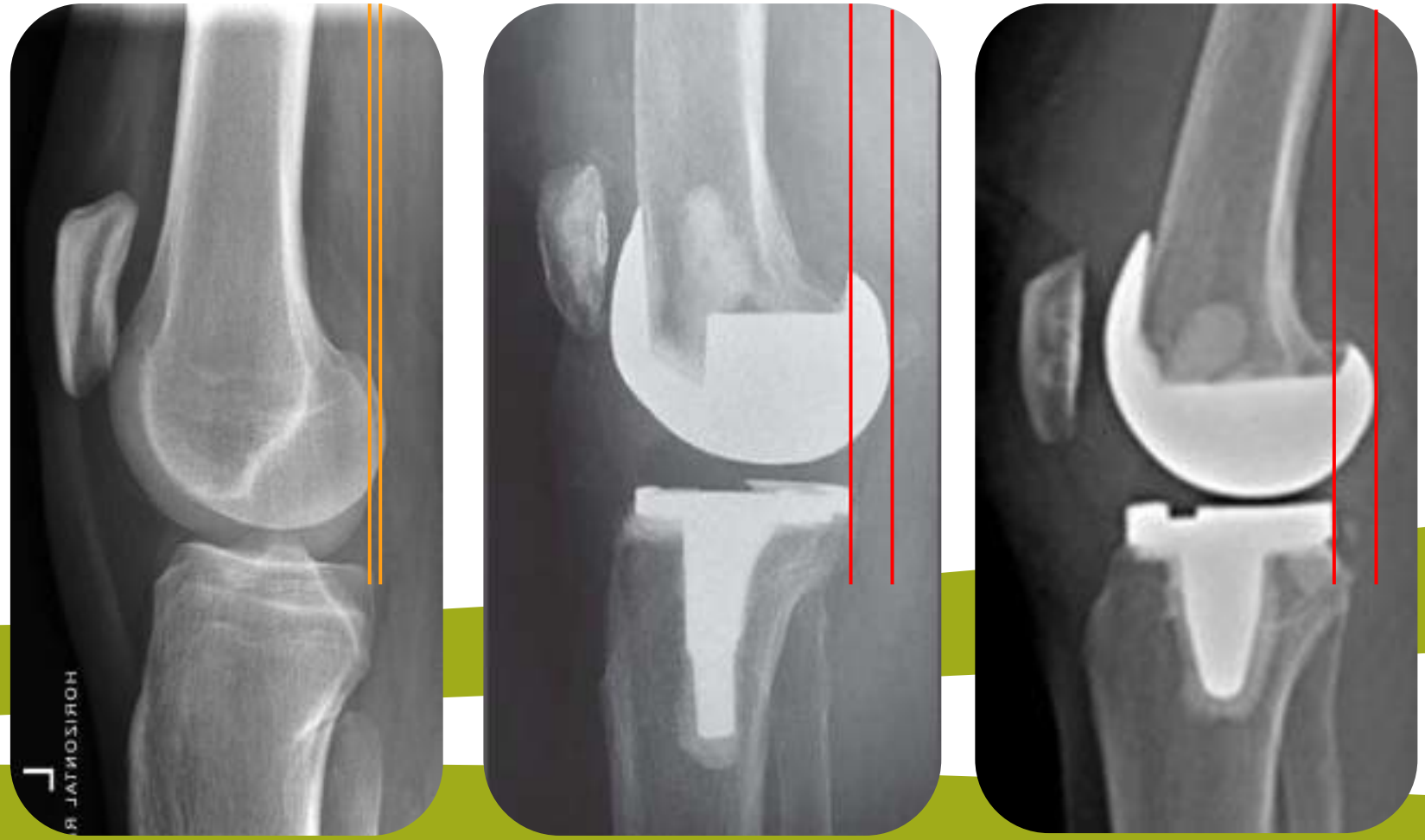
Concave, Conforming radii medial/lateral

Posterior sulcus position
to gain deep flexion



Implant Design changes Kinematics

Conventional Position



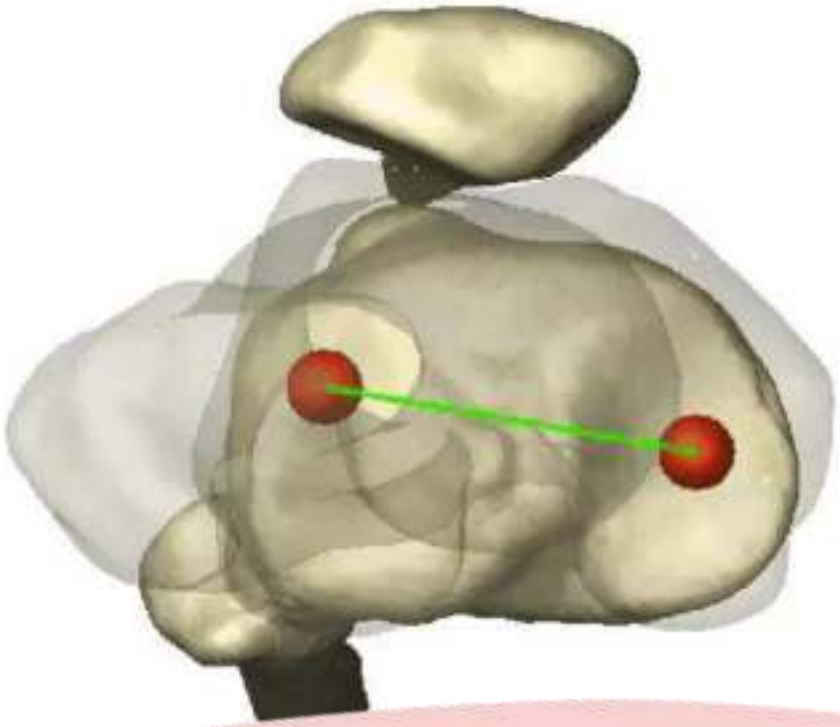
Normal

LEGION◇ TKA

DePuy Attune™

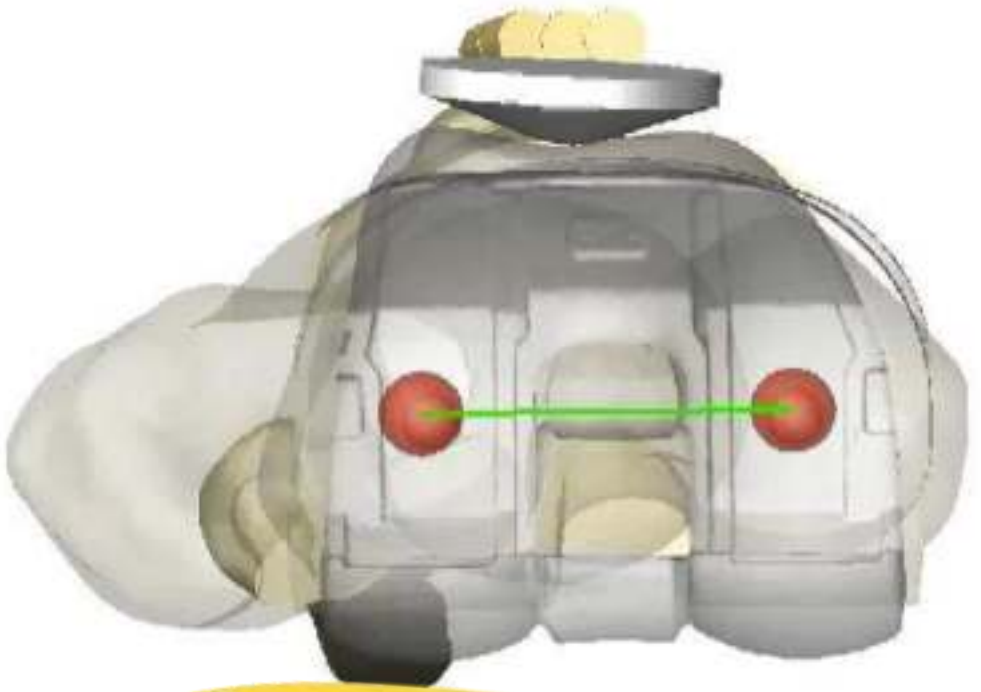
Implant Design changes Kinematics

Conventional Motion



Normal Knee

- No femoral overhang in full-extension
- Medial pivot with lateral rollback (external rotation)
- Bi-lateral **posterior translation** in deep flexion



Conventional TKA

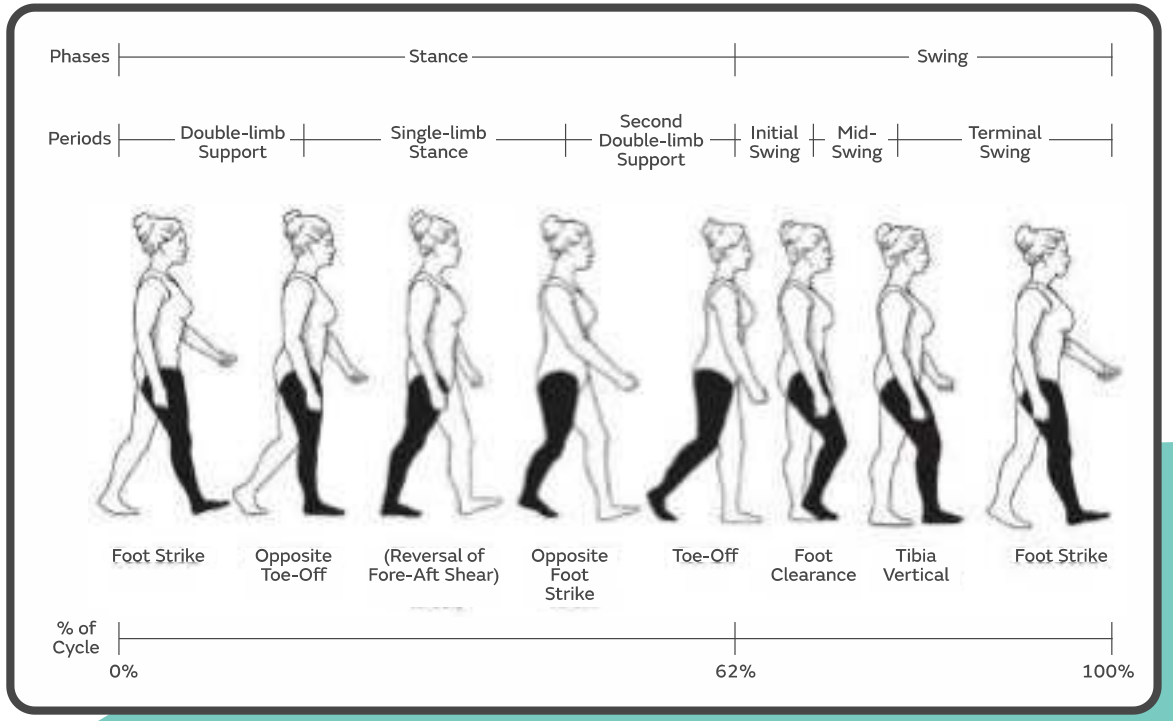
- Femur in non-anatomic posterior position
- **Paradoxical motion** -> Mid-Flexion Instability
- Little to no external rotation

Grieco TF, et al. *J Arthroplasty*. 2018;33(2):565-571.

The design of total knees causes changes in…

Post-operative gait cycle

- Velocity[1,3,4]
- Stride length[1-4]
- Max knee flexion during stance and swing phases[1-3]
- Mid-stance knee flexion (Quad Avoidance Gait)[1-3]



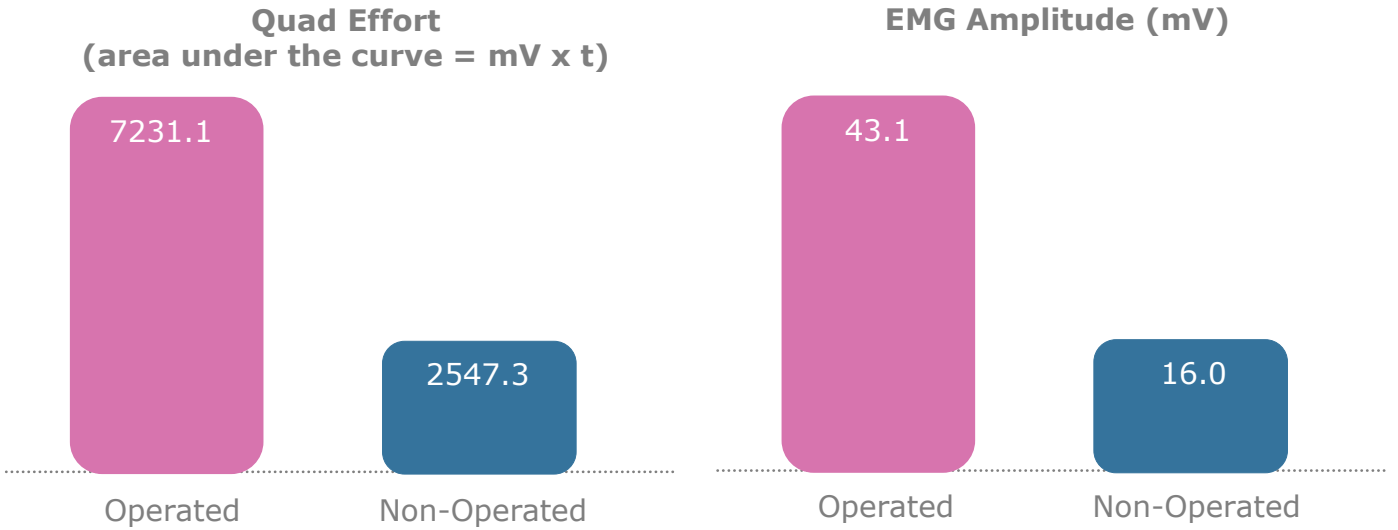
Chambers HG, et al. The Journal of the American Academy of Orthopaedic Surgeons. 2002;10:222-31.

1. Andriacchi TP, et al. *The Journal of Bone and Joint Surgery*. 1982;64(9):1328-1335.
2. Dorr LD, et al. *Clin Orthop Relat Res*. 1988;236:36-43.
3. Kramers IA, et al. *The Journal of Arthroplasty*. 1997;12(2):168-179.
4. Saari T, et al. *Acta Orthopaedica*. 2005;76(2):253-260.

The design of total knees causes changes in…

Reduced muscle efficiency

Image created by Smith+Nephew using data from Lester KD, et al.

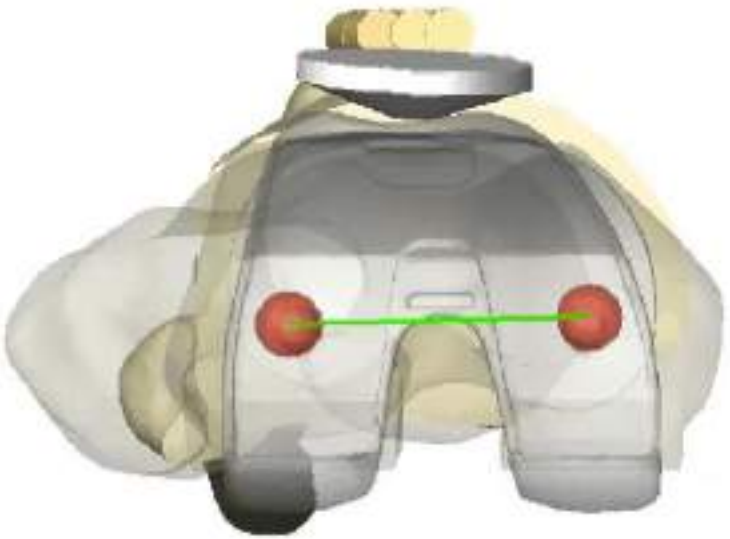


3x quad effort versus non-operated leg

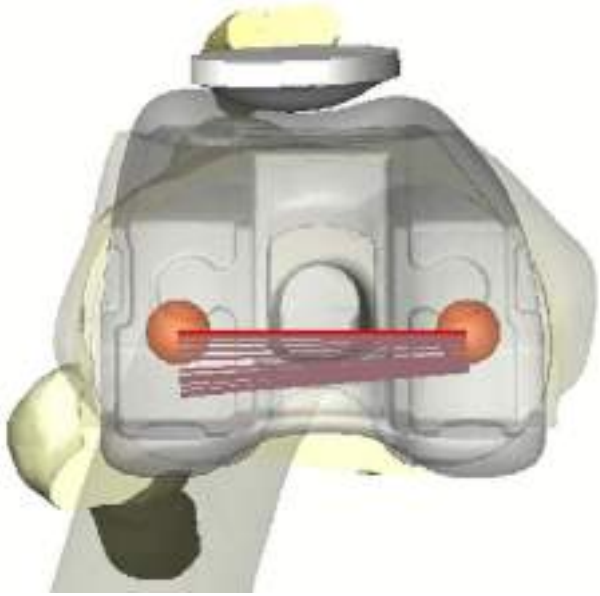
Lester KD, et al. *J Arthroplasty.* 2013;28:557-562.

The design of total knees causes changes in…

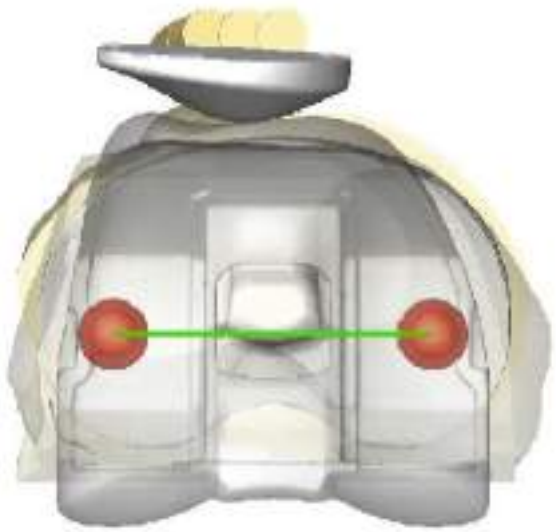
Knee Kinematics



Persona® MC[1]



Triathlon®[2]



Attune®[3]

Conventional TKA

- More Posterior starting position than normal knee[4]
- Paradoxical Motion (anterior sliding)[4]
- Little to no external rotation[4]

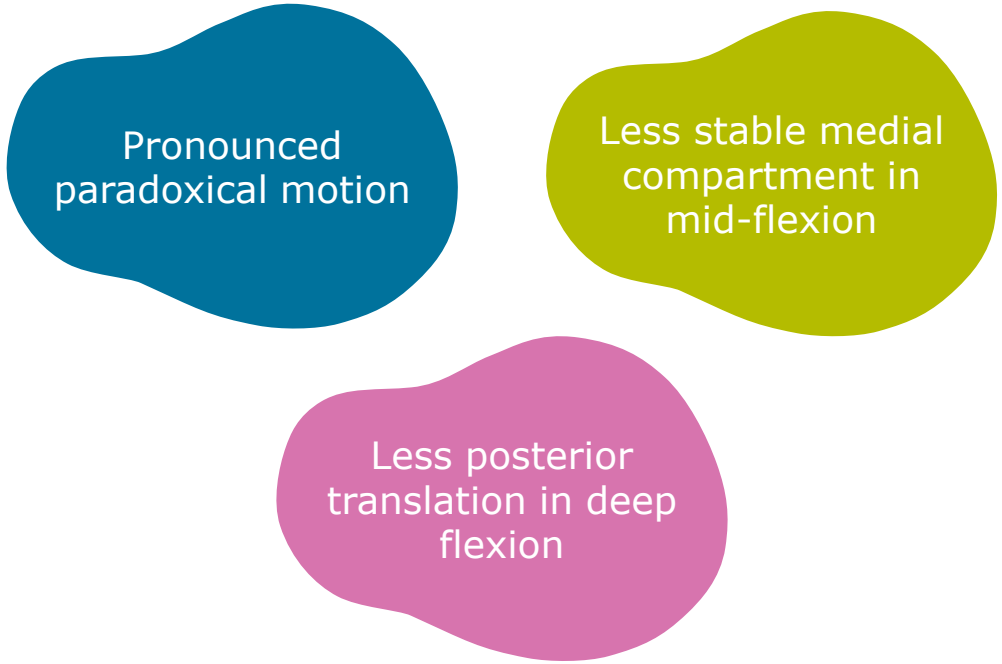
1. Data on file with Smith+Nephew. TM-18-064.
2. Data on file with Smith+Nephew. TM-18-083.
3. Data on file with Smith+Nephew. TM-18-078.
4. Grieco TF, et al. *J Arthroplasty*. 2018;33(2):565-571.

The differences found in the kinematics between normal knees and conventional knees impact function and outcomes.[1-2]

1. Van Onsem S, et al. Clin Orthop Relat Res. 2020;478:255-263.
2. Parcells BW, et al. Am J Orthop. 2016;45:153–160.

Kinematics and Patient Satisfaction

Poor Patient Outcomes are associated with[1]:



The abnormal kinematics associated with conventional TKA may be contributing to these poor outcomes:

- Decreased **satisfaction** with daily activities[2]
- Abnormal gait patterns[3]
- Decreased **stability**[1,4]
- Decreased **confidence**[5]

1. Van Onsem S, et al. Clin Orthop Relat Res. 2020;478:255-263.
2. Noble PC, et al. Clin Orthop Relat Res. 2005;431:157–165.
3. Saari T, et al. Acta Orthopaedica. 2005;76(2):253-260.
4. Lester DK, et al. J Arthroplasty. 2013;28(4):557-562.
5. Huch K, et al. Ann Rheum Dis. 2005;64(12):1715-1720.

Knees vs hips

Post TKA: sport activities **decreased from 42% to 34%**[1]

Post THA: sport activities **increased from 36% to 52%**[1]

1. Huch K, et al. *Ann Rheum Dis*. 2005; 64:1715-1720.

Total Knees vs Partial Knees

Compared to TKA, Partial Knee Patients experience:

Better
Range of Motion[1]

Better
Quadricep Function[1]

More Normal
Gait[1]

More Normal
Kinematics[2]

Higher
Forgotten Joint Scores (FJS)[1]
74.3 vs **59.8**

1. Zuiderbaan HA, et al. Knee Surg Sports Traumatol Arthrosc. 2017;25(3):681-686.
2. Wilson HA, et al. BMJ. 2019;364:l352.

“Reproduction of optimal kinematic patterns during TKA could be instrumental in improving patient satisfaction.”

-Van Onsem et al.

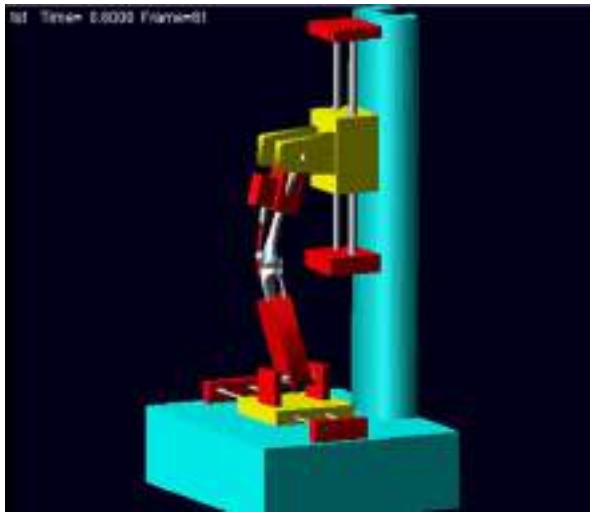
Van Onsem S, et al. Clin Orthop Relat Res. 2020;478:255-263.

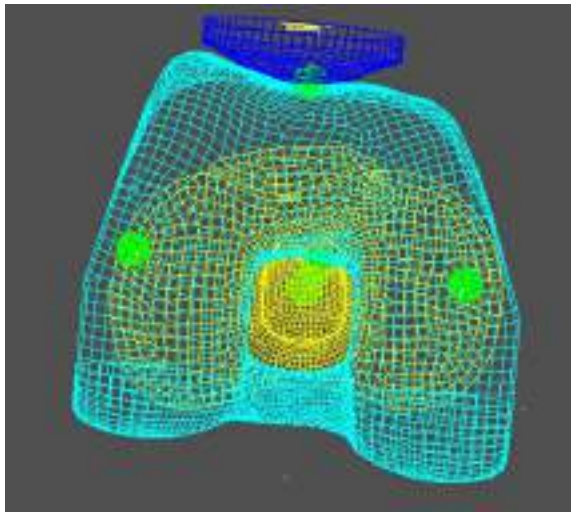
The solution to providing patients with higher satisfaction and functionality is to design an implant as close to the normal knee as possible.

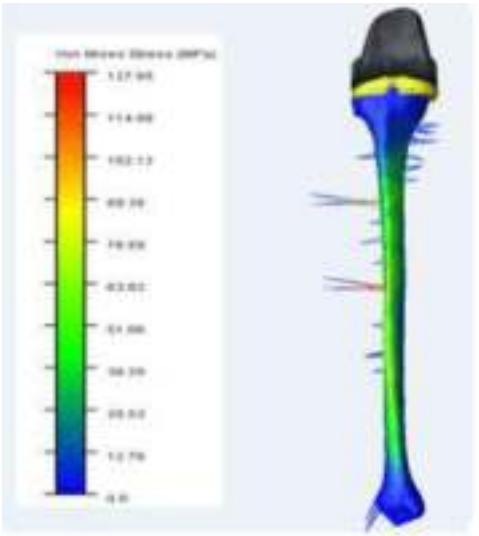
JOURNEY◊ II TKA

Total Knee Arthroplasty

Designing normal



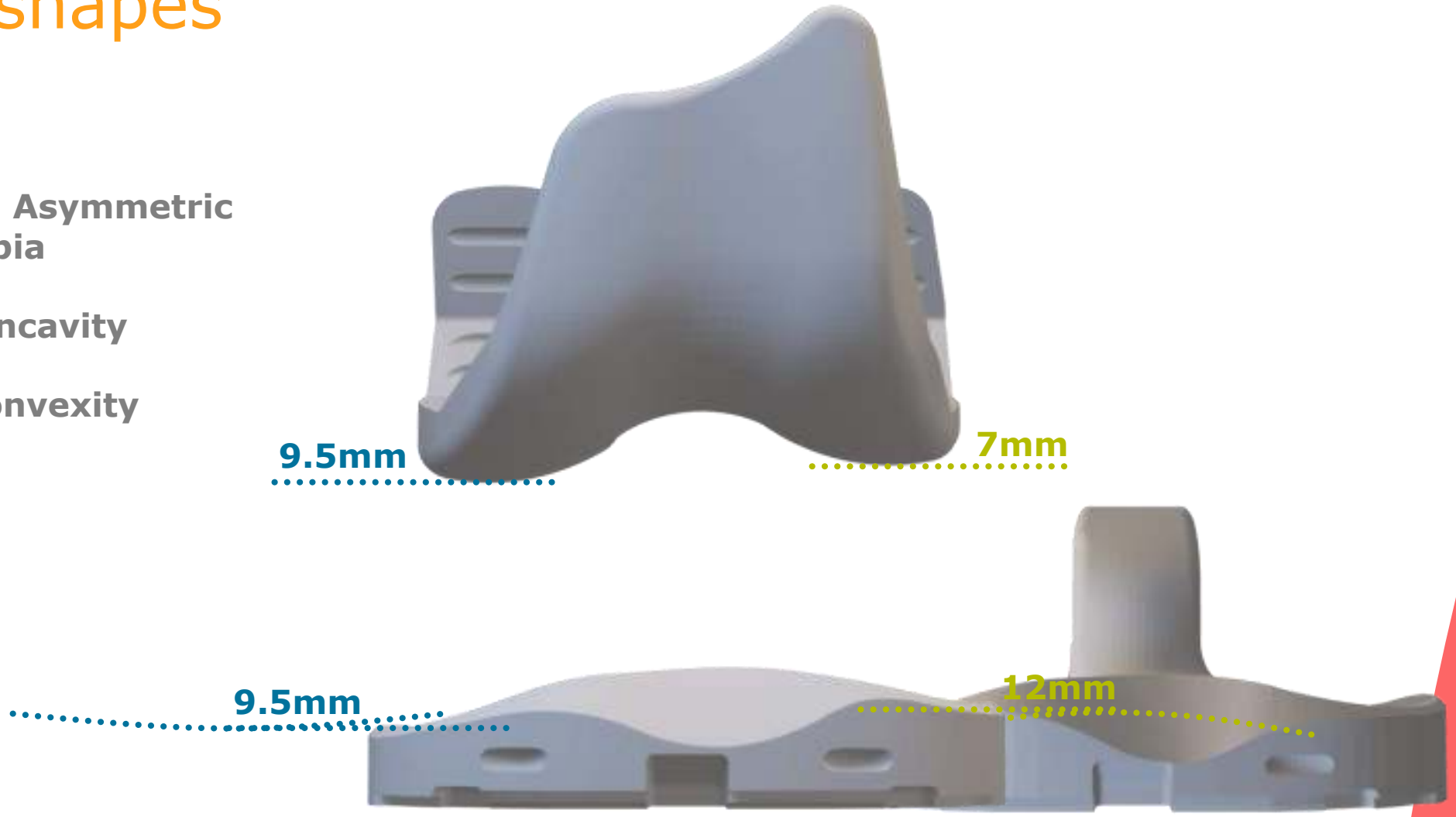




+ LifeMOD/KneeSIM

Normal shapes

- **Anatomic, Asymmetric Femur/Tibia**
- **Medial Concavity**
- **Lateral Convexity**

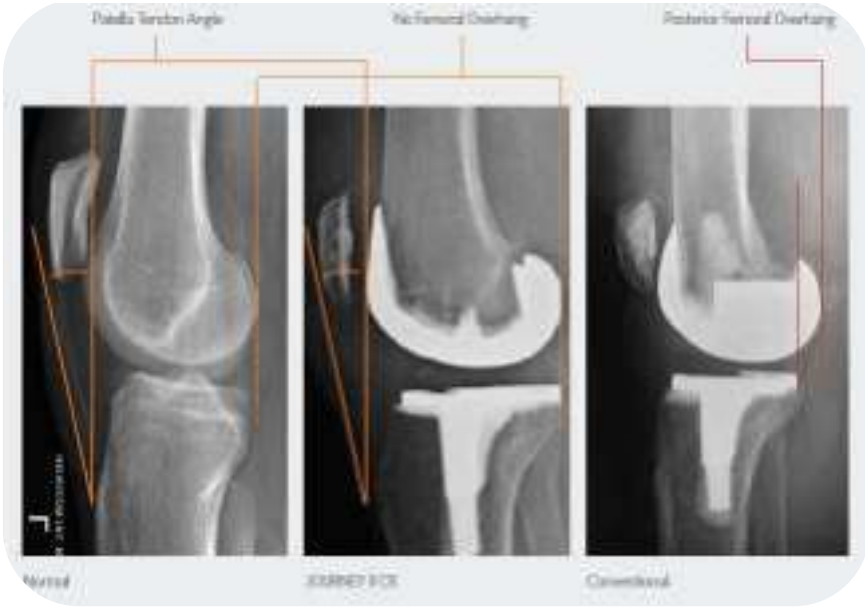


Medial Concavity Promotes Medial Pivot[1-2]

Lateral Convexity Promotes Native Rollback[1-2]

1. Grieco TF, et al. *J Arthroplasty*. 2018;33(2):565-571.
2. Kaneko T, et al. *J Orthop*. 2017;14(1):201-206.

Normal position



Mid-Line Sulcus Position

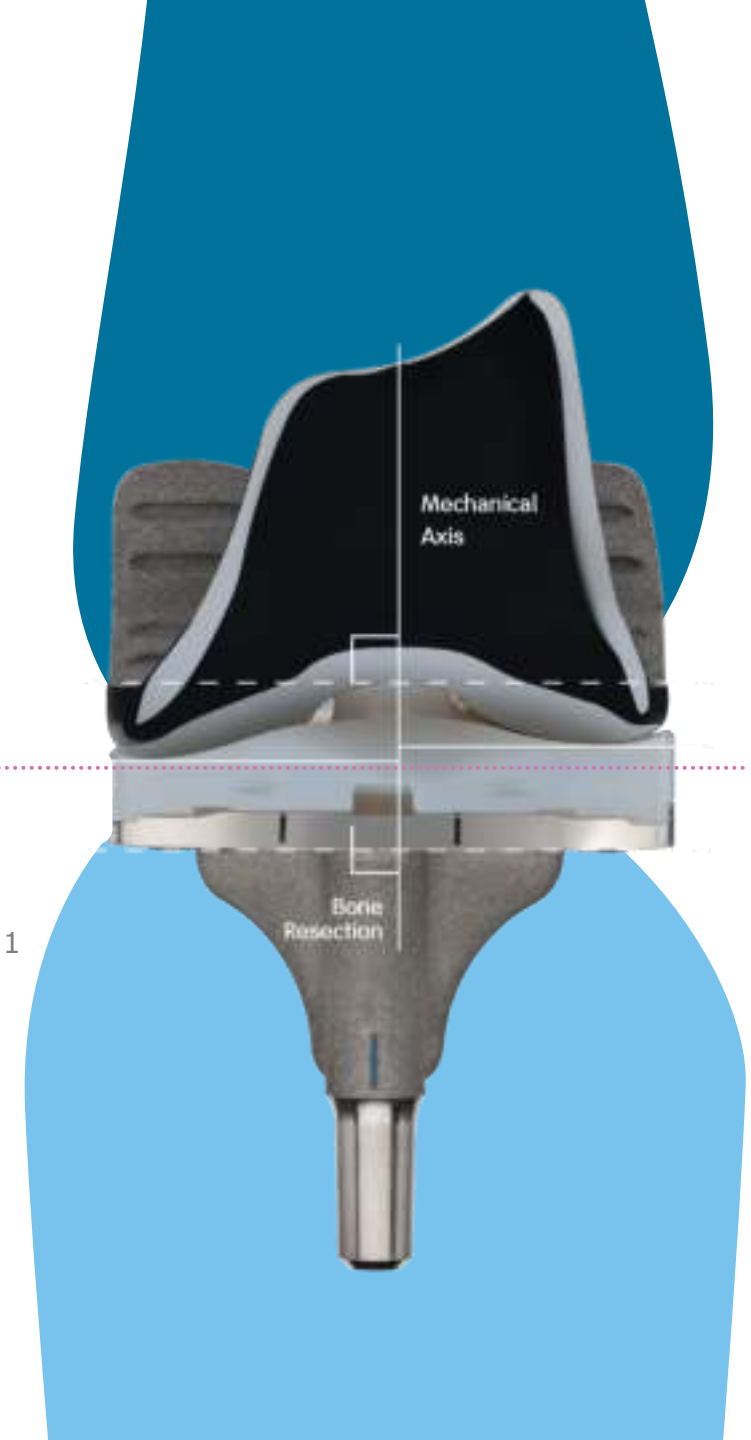
- Restores knee's normal AP position, **preventing paradoxical motion**[1]
- Promotes **musculature efficiency** throughout the range of motion[2]
- Promotes more natural patella tracking[3]

1. Grieco TF, et al. *J Arthroplasty*. 2018;33(2):565-571.
2. Lester et al. *J Arthroplasty.* 2013;28:557-562.
3. Laskin R. *The Knee*. 1999;6:87-93.

Normal position

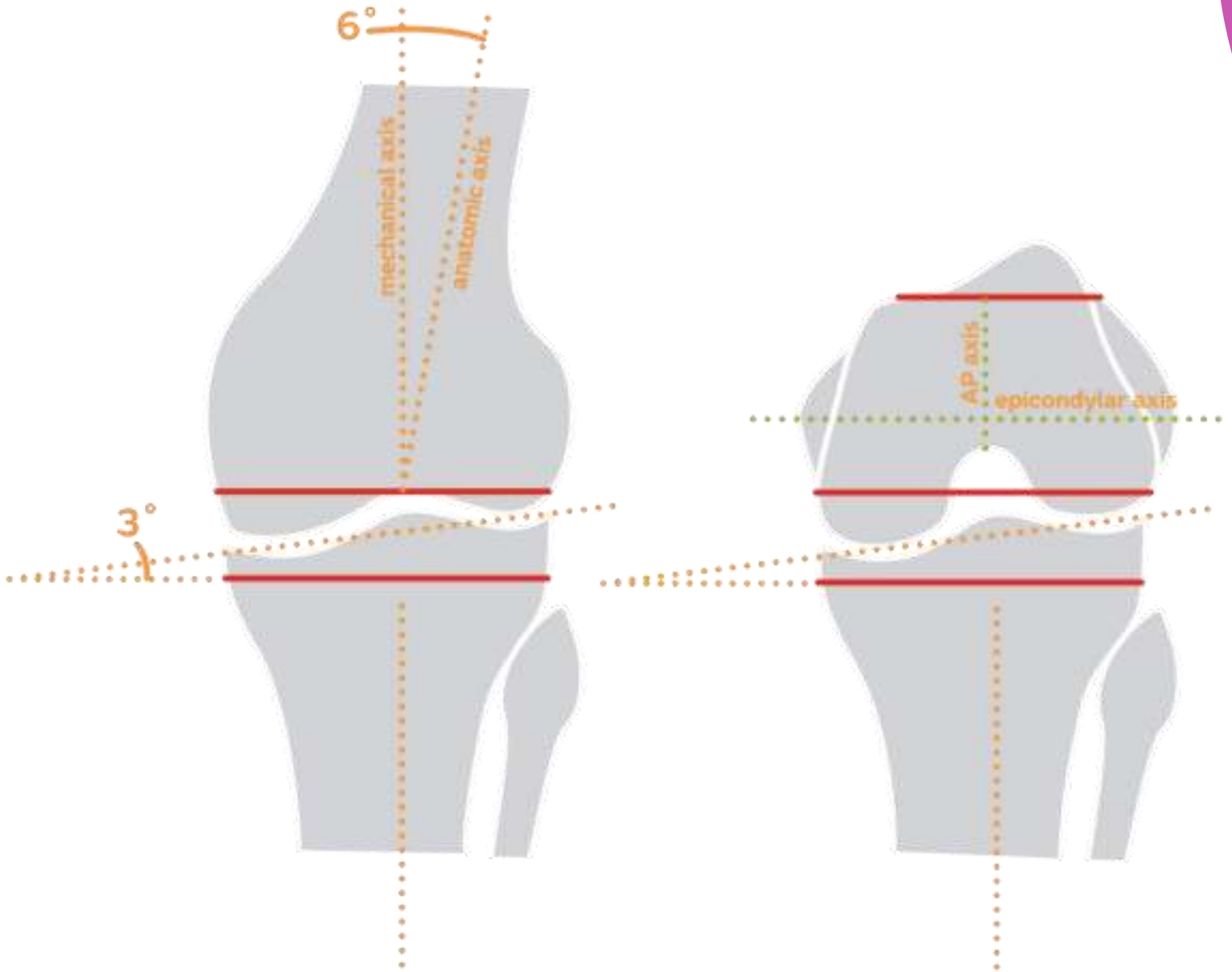
3° Anatomic Joint-Line

- Promotes more normal ligament tension
- Natural patella-femoral tracking[1]



1. Grieco TF, et al. *J Arthroplasty*. 2018;33(2):565-571.

Normal position



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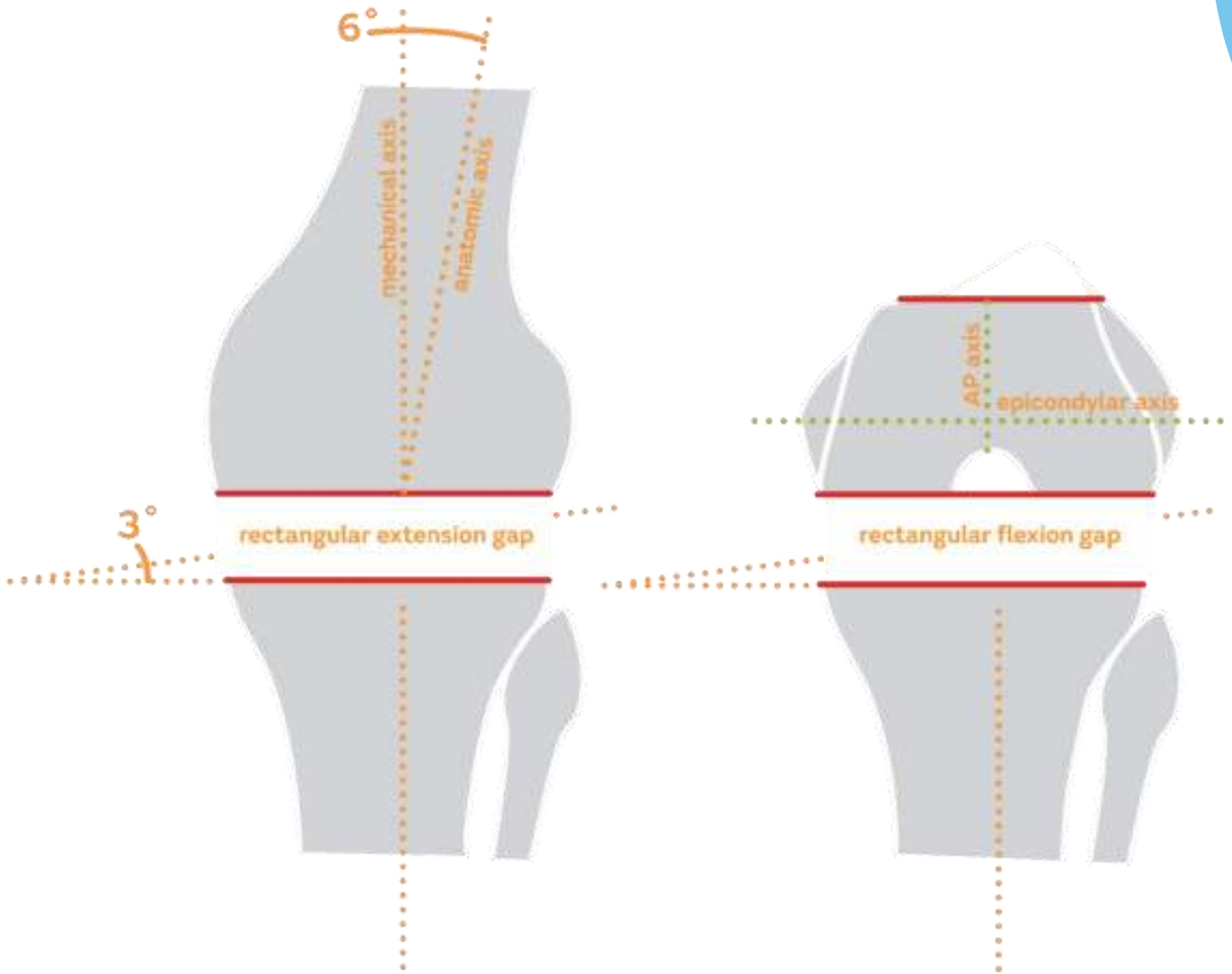
For illustration purposes only.

Normal position



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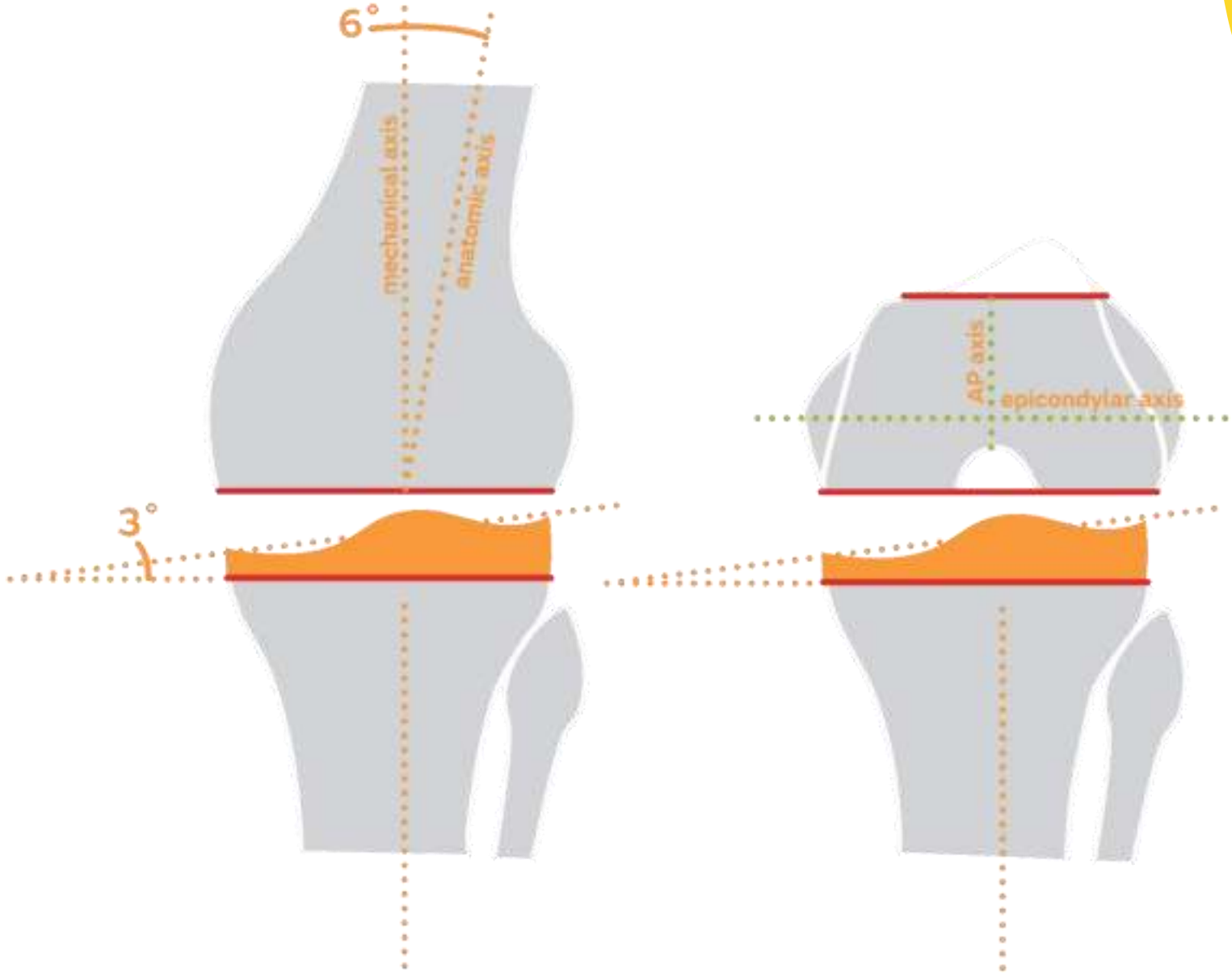
Normal position



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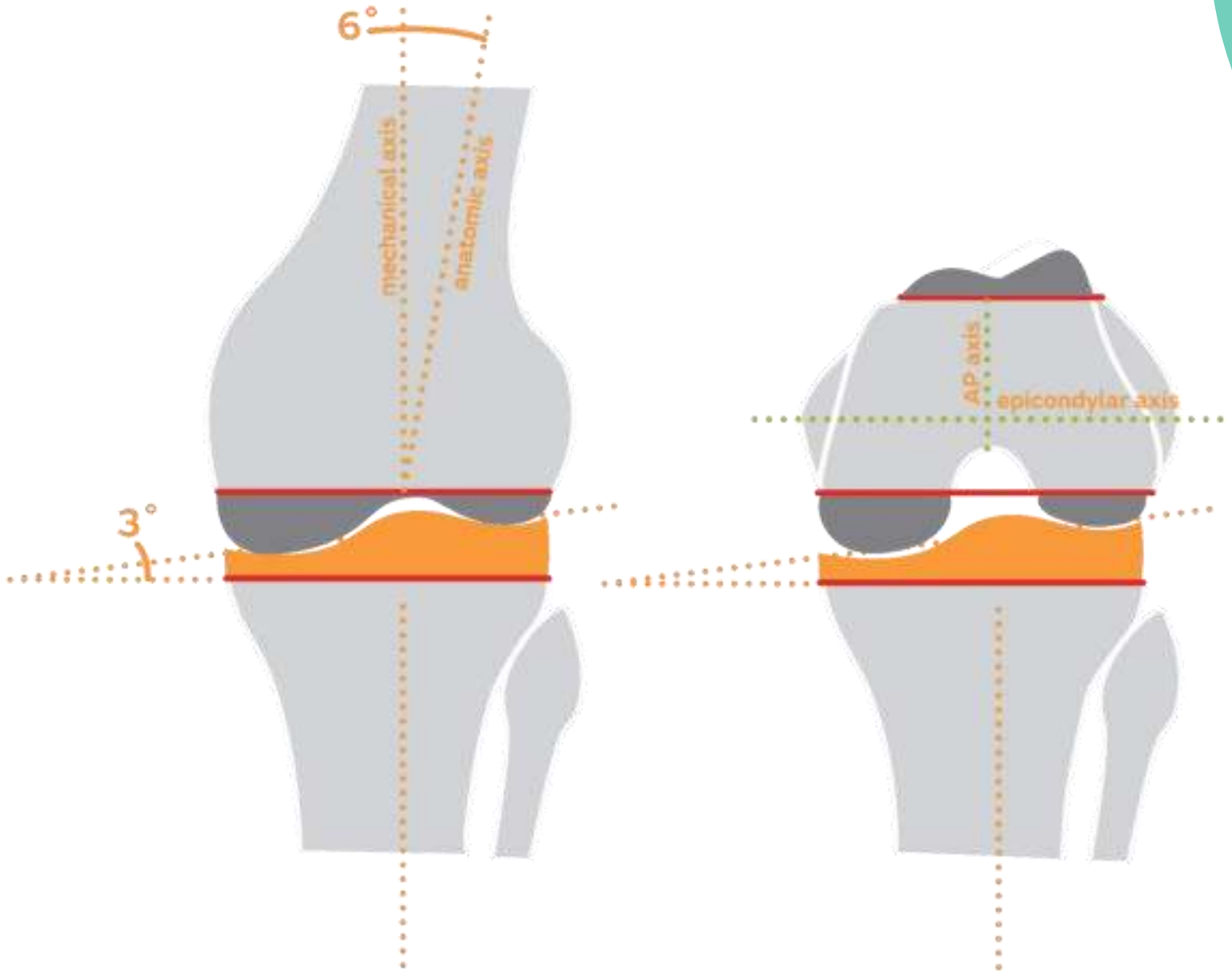
Normal position



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For illustration purposes only.

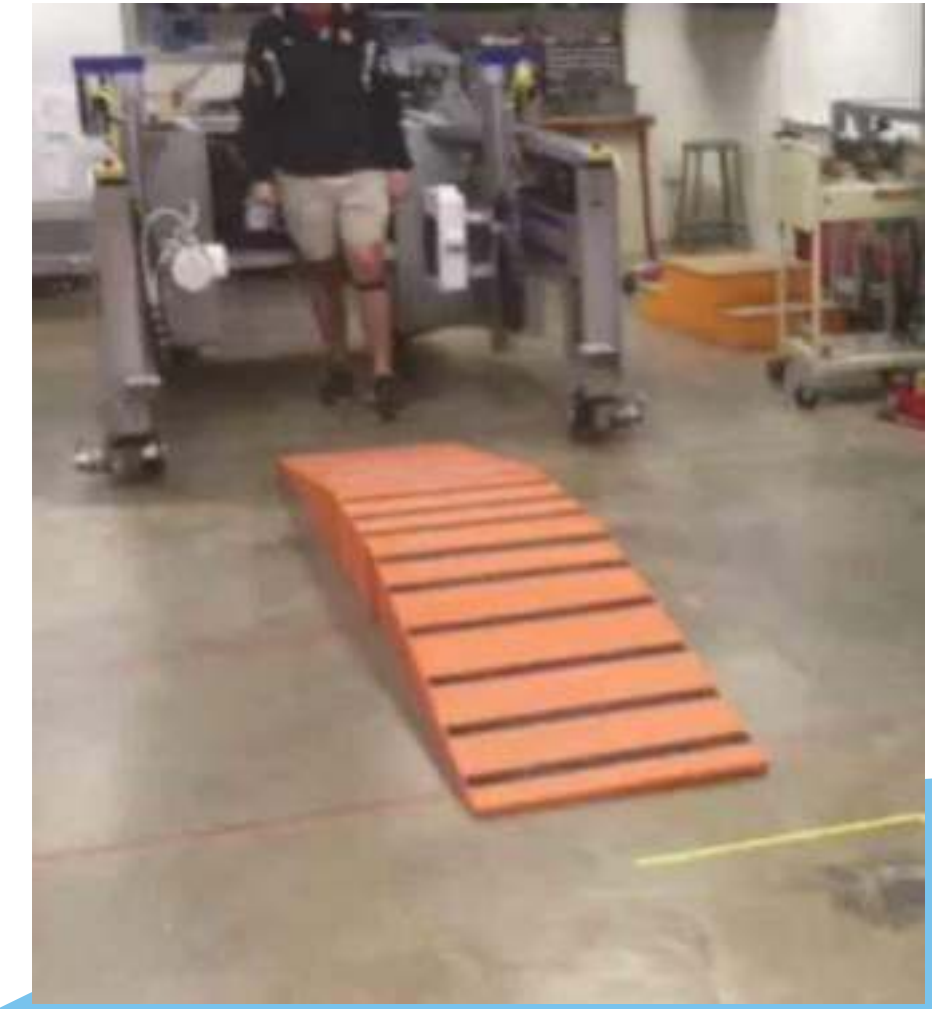
Normal motion

Deep flexion

- Maximum flexion tested to **155°**
- 15° posterior flex cut

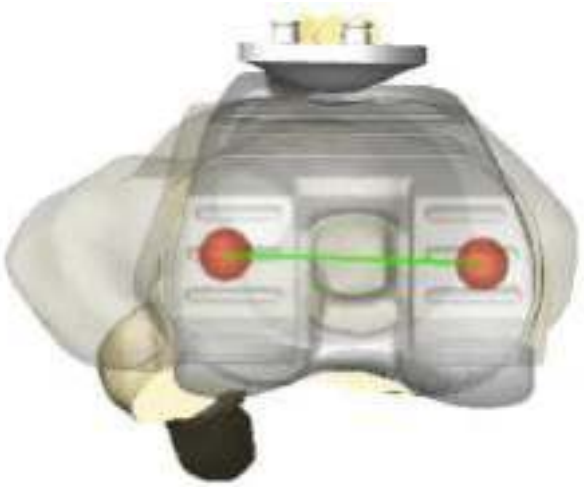
In Vivo kinematics

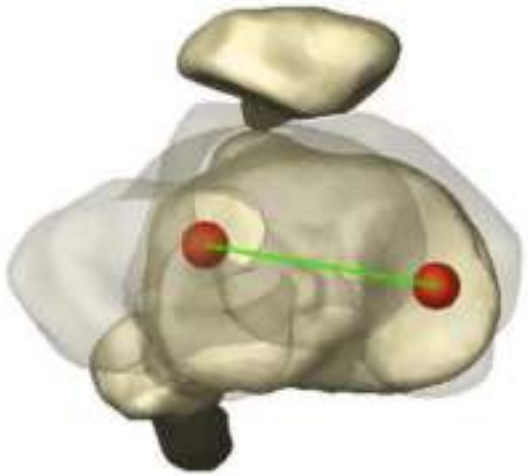
- JOURNEY◇ II TKA kinematic studies show **normal rollback** and **external rotation**[1,2]

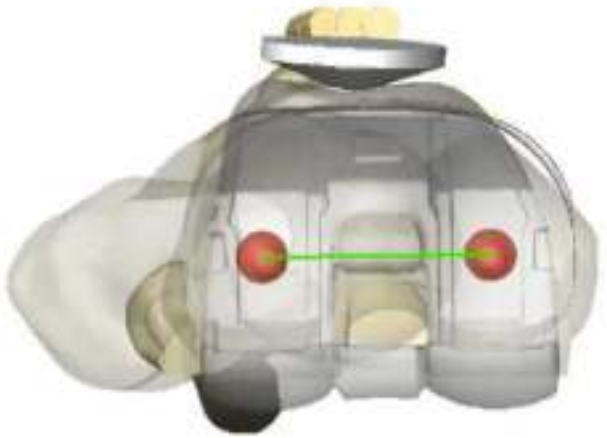


1. Grieco TF, et al. *J Arthroplasty*. 2018;33(2):565-571.
2. Murakami K, et al. *Int Orthop*. 2018;42:2573-2581.

Normal motion







JOURNEY◇ II

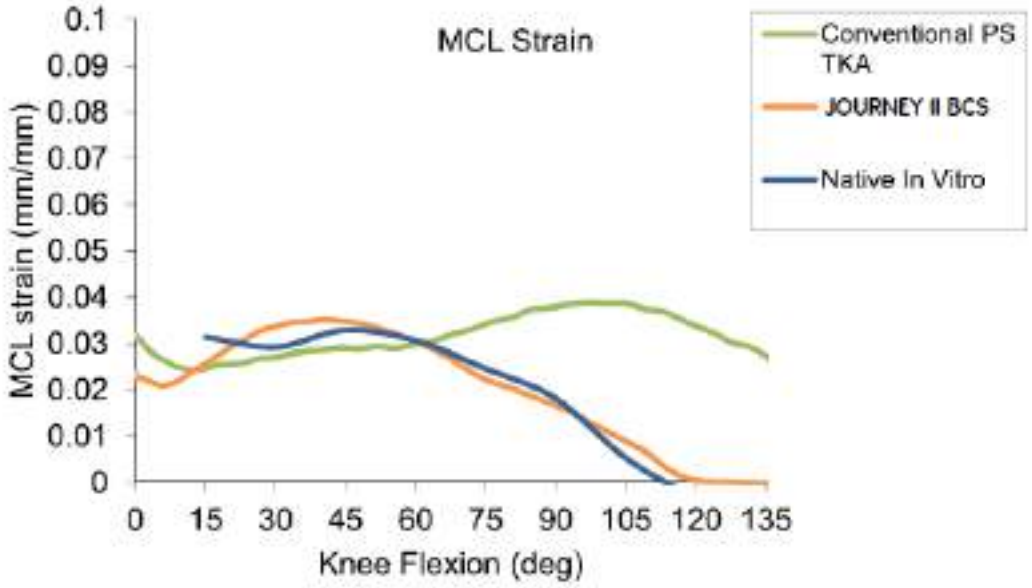
Normal

Conventional

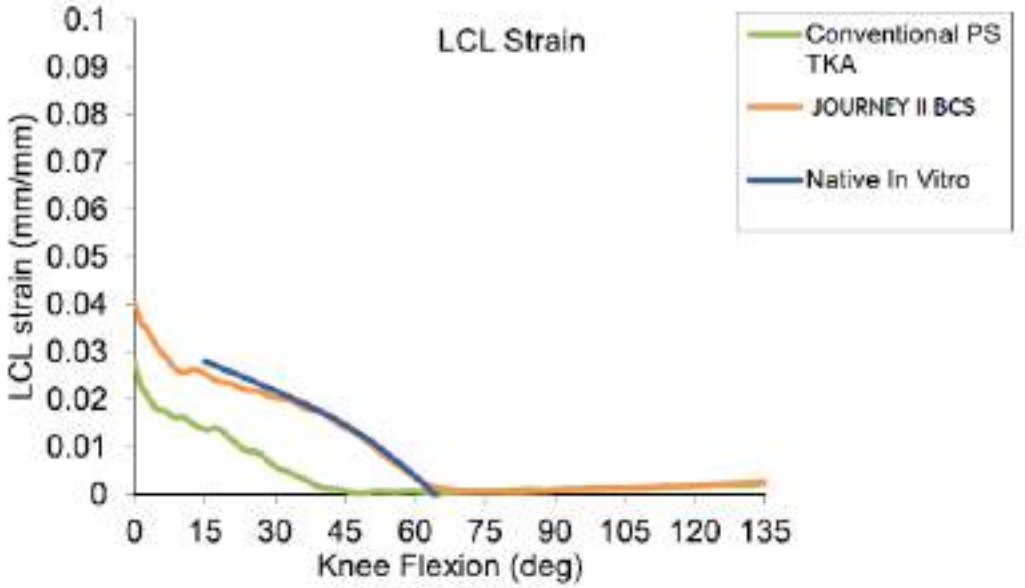
Normal ligament tension

Effects of implant design on ligaments:

Anatomic strain patterns



Ligament behavior comparison - MCL strain



Ligament behavior comparison - LCL strain

Harfe DT, et al. *Clinical Biomechanics*. 1998;13(3):163-175.

What this means to your patients

Smoother Recovery

Improved Function

Higher Patient Satisfaction

They can now **+Rediscover normal**

Rediscover normal

Smoother Recovery[1,3]

Nodzo, Mayman et al.
JOURNEY II BCS **showed improvements in Mean KSS** at 6 weeks over conventional TKA (88 vs 73)[1]

Di Benedetto et al.
Compared to Attune CR, JOURNEY II CR has been shown **to improve muscle activation and strength** in the early recovery period.[2]

Mayman et al.
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.[3]

Lutes et al.
JOURNEY II CR showed significant ($p<0.05$) **improvements in patient-reported KSS** at 3 months post-TKA compared to a conventional CR design.[4]

*$p<0.0001$

Improved Function[1,11-13]

Nodzo, Mayman et al.
23º ROM improvement at 1-year follow-up vs standard PS design[1]

Iriuchishima et al.
Restores function and motion comparable to bi-cruciate retaining Oxford Uni Knees (UKA).[5]

Grieco, Komistek et al.
Exhibits normal-like knee kinematic patterns suggesting the dual cam-post design and asymmetric articular geometries adequately replicate ACL and PCL function.[6]

Smith, Komistek et al.
JOURNEY II CR knees demonstrated an **improvement in lateral femoral rollback and axial rotation** compared to previous studies on CR knees.[7]

Kaneko et al.
Provides medio-lateral stability in the mid-flexion range and reproduces the **same medial pivot as normal knees**, aiding in patient recovery.[8]

Higher Patient Satisfaction[1,11,14]

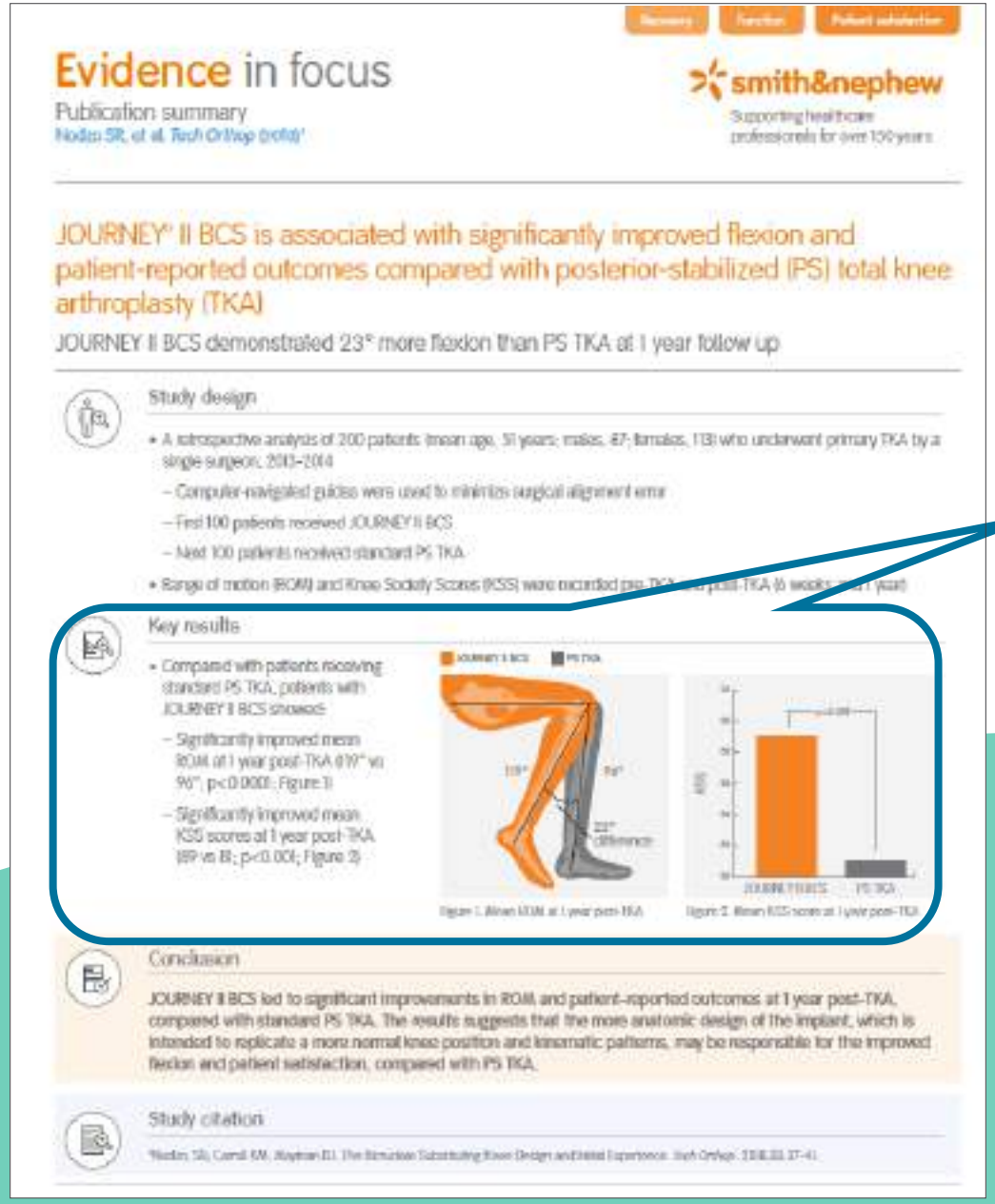
Nodzo, Mayman et al.
Significantly better KSS scores than standard PS designs at one year follow-up, resulting in reducing patient dissatisfaction.[1]

Harris et al.
Significant* improvements in patient-reported KSS and movement-associated pain at 24 months post-TKA.[9]

Snyder et al.
Compared to a Total Hip cohort, JOURNEY II BCS showed no statistical difference in patient satisfaction[10]

Lutes et al.
JOURNEY II CR showed Significant improvements in KSS, WOMAC, and ROM compared to Sigma.[4]

1. Nodzo, SR; Carroll KM, Mayman DJ. The Bicruciate Substituting Knee Design and Initial Experience. Tech Orthop. 2018;33:37-41. **2.** Di Benedetto P, Vidi D, Colombo, Buttironi MM, Cainero V, Causero A. Pre-operative and post-operative kinematic analysis in total knee arthroplasty. A pilot study. Acta Biomed. 2019;90:91-97. **3.** 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. **4.** 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. **5.** Iriuchishima, Takanori, and Keinosuke Ryu. "A Comparison of Rollback Ratio between Bicruciate Substituting Total Knee Arthroplasty and Oxford Unicompartmental Knee Arthroplasty." The Journal of Knee Surgery, 2017, doi:10.1055/s-0037-1604445. **6.** Grieco, Trevor F., et al. "In Vivo Kinematic Comparison of a Bicruciate Stabilized Total Knee Arthroplasty and the Normal Knee Using Fluoroscopy." The Journal of Arthroplasty, 2017, doi:10.1016/j.arth.2017.09.035. **7.** Smith LA, Nachtrab J, LaCour M, Cates H, Freeman MG, Komistek RD. In vivo knee kinematics: how important are the roles of femoral geometry and the cruciate ligaments? J Arthroplasty. 2020: doi: https://doi.org/10.1016/j.arth.2020.10.020. **8.** Kaneko, Takao et al. Bi-cruciate substituting total knee arthroplasty improved medio-lateral instability in mid-flexion range. Journal of Orthopaedics. 14. 201-206. 10.1016. **9.** Harris AI, Luo TD, Lang JE, Kopjar B. Short-term safety and effectiveness of a second-generation motion-guided total knee system. Arthroplast Today. 2018 Feb 16. [Epub ahead of print] **10.** 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. Ortop Travmatol Protez. 2018;3:5-10. **11.** Murakami K, Hamai S, Okazaki K, et al. In vivo kinematics of gait in posterior-stabilized and bicruciate-stabilized total knee arthroplasties using image-matching techniques. Int Orthop.2018;42(11):2573-2581. **12.** Kosse NM, Heesterbeek PJC, Defoort KC, Wymenga AB, Hellemondt GG. 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. **13.** Takubo A, Ryu K, Iriuchishima T, Tokuhashi Y. Comparison of Muscle Recovery Following Bi-cruciate Substituting versus Posterior Stabilized Total Knee Arthroplasty in the Asian Population. J Knee Surg. 2017;30(7):725-729. **14.** Noble P.C, Scuderi G.R, Brekke A.C, et al. Development of a New Knee Society Scoring System. Clin Orthop Relat Res 2012;470(1):20-32.



Evidence in focus

Publication summary

Nodzo SR, et al. Tech Orthop (xxxx)

smith&nephew

Supporting healthcare professionals for over 150 years

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)

Figure 1. Mean ROM at 1 year post-TKA

Figure 2. Mean KSS scores at 1 year post-TKA

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 suggests 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.

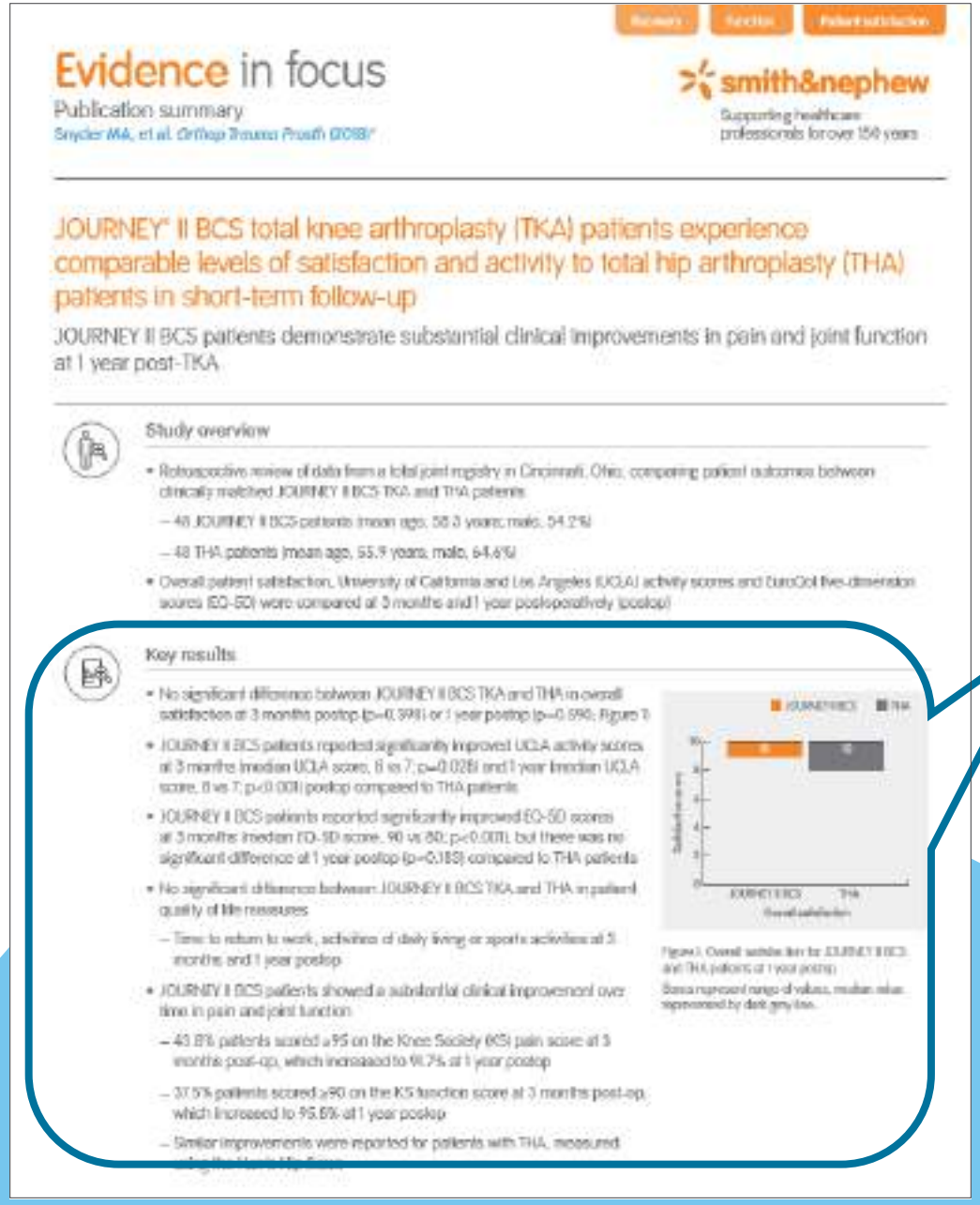
Study citation

Nodzo SR, Carroll KM, Mayman DJ. The Bicruciate Substituting Knee Design and Clinical Experience. Tech Orthop. 2018;33:37-41.

Nodzo, Mayman et al.

100 JOURNEY◇ II BCS vs 100 PS

- 23° ROM Improvement at 1-year
- Improved KSS scores at 1 year (89 vs 81)



Evidence in focus

Publication summary

Snyder MA, et al. Orthop Trauma Prosth (2018)

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Supporting healthcare professionals for over 150 years

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=0.998) or 1 year postop (p=0.696; Figure 1)
- JOURNEY II BCS patients reported significantly improved UCLA activity scores at 3 months (median UCLA score, 6 vs 7; p=0.026) 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 ≥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 ≥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

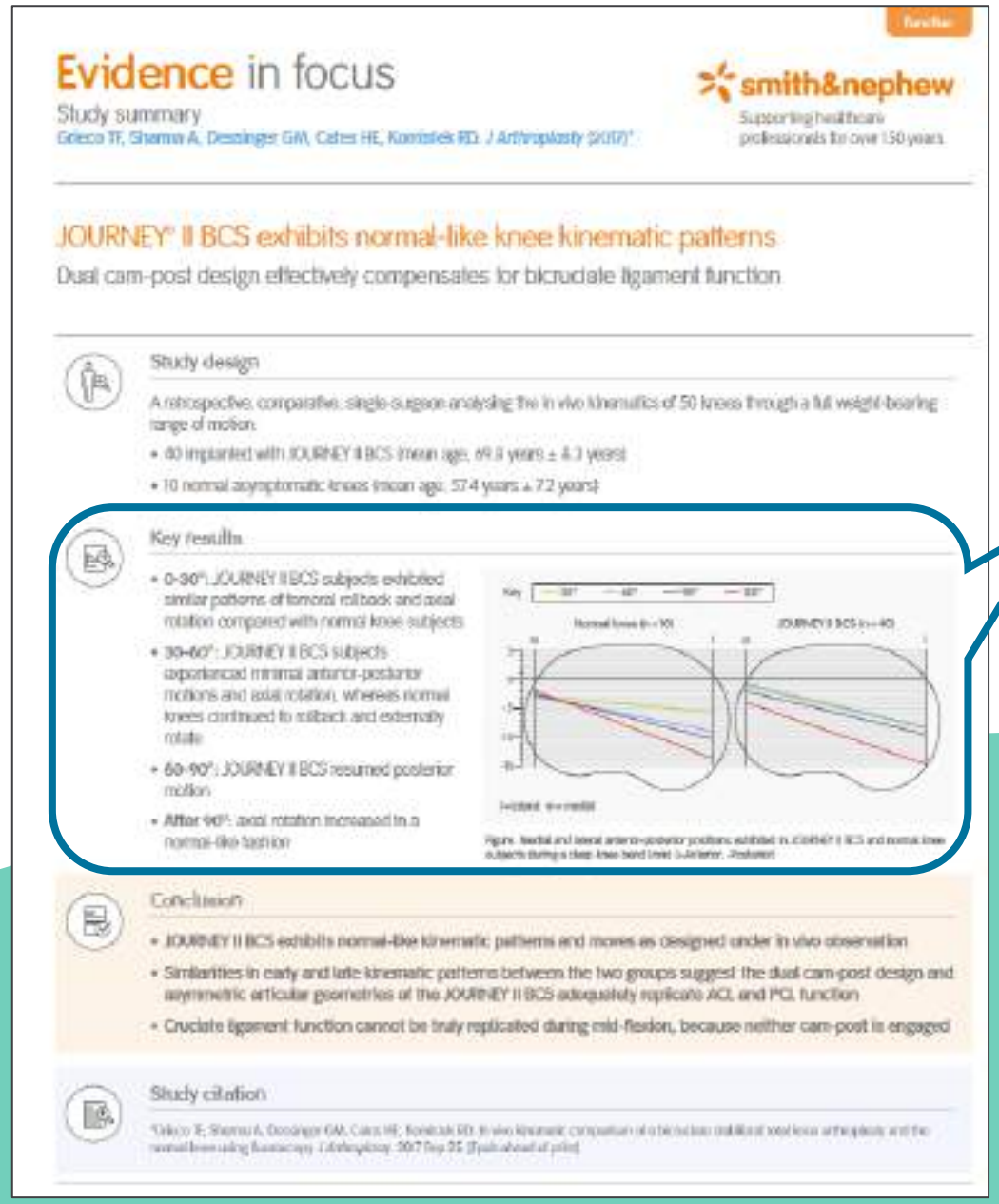
Figure 1. Overall satisfaction for JOURNEY II BCS and THA patients at 1 year postop

Boxes represent ranges of values, median values represented by dark grey lines.

Snyder et al.

48 JII Knees vs. 48 Hips

- First known study to show knee satisfaction similar to hip satisfaction
- No significant difference in overall satisfaction and quality of life between JII and THA patients (3-months and 1-year)
- JII patients reports significantly improved UCLA scores compared to THA patients



Evidence in focus

Study summary

Grieco TF, Sharma A, Dessinger GM, Cates HE, Komistek RD. J Arthroplasty (2017)*

smith&nephew

Supporting healthcare professionals for over 150 years

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

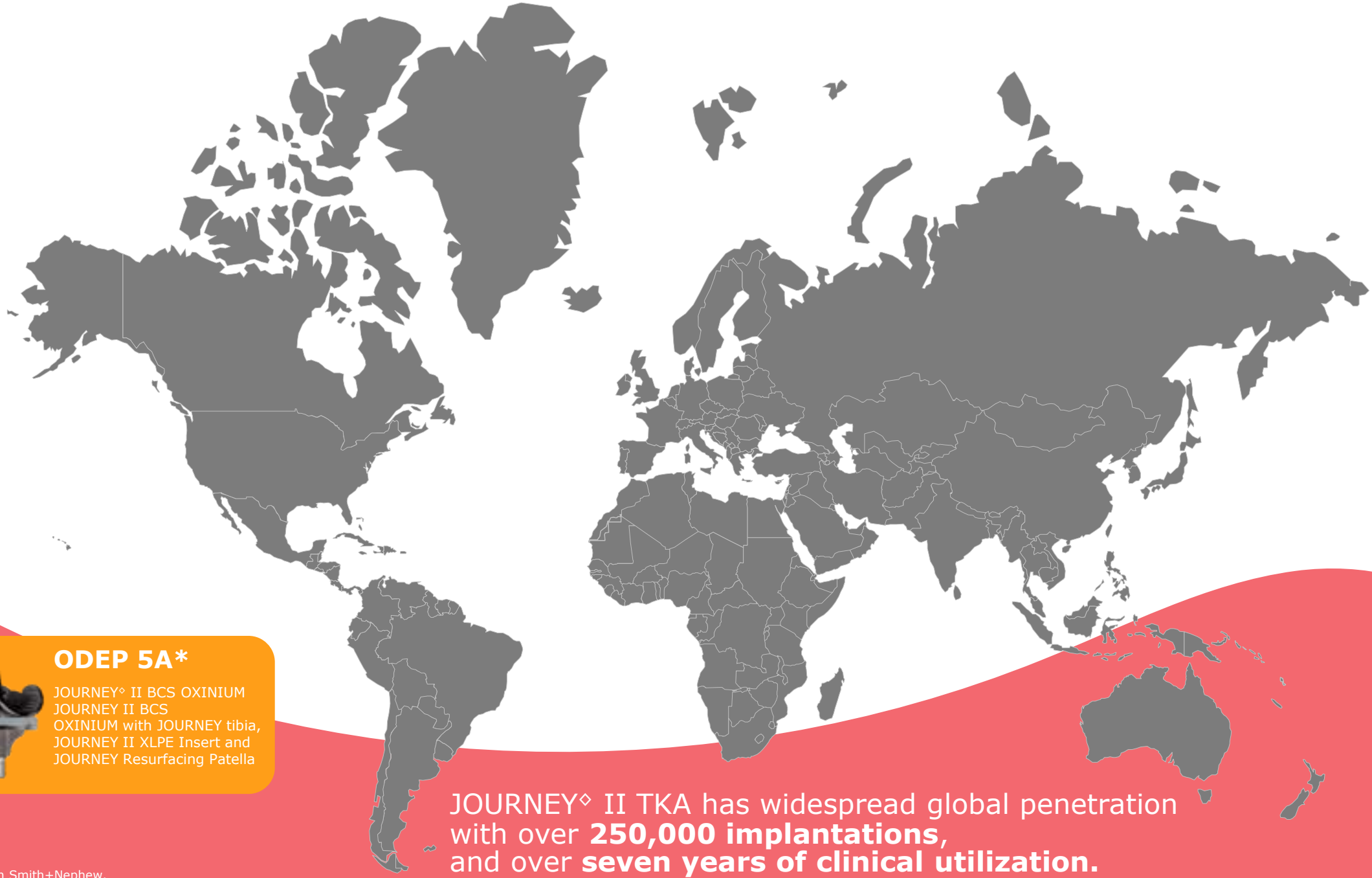
Conclusion

- 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

Grieco, Komistek et al.

- JOURNEY II BCS exhibits normal-like kinematic patterns and moves as designed
  - Femoral rollback and axial rotation compared with normal knee subjects (0-30°)
  - Axial rotation increase in a normal-like fashion (past 90°)
- Dual cam-post design and asymmetric articular geometries adequately replicate ACL and PCL Function



ODEP 5A*

JOURNEY◇ II BCS OXINIUM
JOURNEY II BCS
OXINIUM with JOURNEY tibia,
JOURNEY II XLPE Insert and
JOURNEY Resurfacing Patella

JOURNEY◇ II TKA has widespread global penetration with over **250,000 implantations**, and over **seven years of clinical utilization.**

Data on file with Smith+Nephew.
Latest ODEP ratings can be found at www.odep.org.uk (last accessed on 2nd Mar 2021)

JOURNEY◇ II TKA portfolio

	XR◇	CR	BCS	Revision
10 AP Sizes Same AP Box				
Kinematic Options				
Constrained Options				
Seamless Primary -> Revision				
	8 anatomic sizes (L/R)	9 anatomic sizes (L/R)	9 anatomic sizes (L/R)	Primary Stem Options / Revision Stem Options

Enabling technologies with Recon Portfolio

JOURNEY◊ II TKA
Total Knee Arthroplasty

Real Intelligence

OXINIUM◊

RI.KNEE NAVIGATION

CORI◊ Surgical System

VISIONAIRE◊ Adaptive Guides

Questions?