Today's fastest growing segment of knee replacement patients is seeking a return to a more active lifestyle.\textsuperscript{1}

Traditional knee replacement options don't meet the need for higher functionality, improved motion or long-term durability.\textsuperscript{2,3,4,5} Most significantly, these traditional systems fall short in providing a return to a normal pattern of motion. Lack of motion, both selection and kinematics, can mean less satisfaction for patients who are unable to return to the demanding activities of their active lifestyle. Surgeons are left tempering patient expectations and tolerating the limited capabilities of traditional knee replacements.
For orthopaedic surgeons seeking treatment solutions beyond traditional knee replacements, JOURNEY™ II Bi-Cruciate Stabilized has been engineered to empower patients with a renewed right to an active lifestyle by breaking through traditional knee replacement barriers and delivers unmatched Function, Motion and Durability through PHYSIOLOGICAL MATCHING Technology.
Function

Stability

- Anatomic, articular surfaces are designed to restore native anatomy and yield a normal anatomic A/P position throughout the range of motion.

- ACL replicated by anterior cam-post interaction providing anterior stabilization during early gait (up to 20° flexion) and in contact only if needed. A 76% return to normal AP stability is shown in the original BCS design. 14

- Provides a proper femoro-tibial A/P position yielding a virtual elimination of paradoxical motion, anterior sliding of the femur during flexion. 6-13

Anterior stability – ACL function

Bi-Cruciate Stabilized

Stability Throughout a Range of Motion

![Lachman test JOURNEY TKA patients](chart)

<table>
<thead>
<tr>
<th>Number of patients</th>
<th>Normal ≤2mm</th>
<th>Abnormal &gt;2mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>0</td>
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<tr>
<td>15</td>
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<td>15</td>
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<tr>
<td>0</td>
<td>0</td>
<td>16</td>
</tr>
</tbody>
</table>

Normal < 2mm

Abnormal > 2mm

Mid-line Sulcus

Anterior Cam

Posterior Medial Lip/Horn

Posterior Cam
Strength

• More normal muscle firing patterns are expected due to the proper A/P positioning, thereby preventing muscle fatigue during activities of daily living.

• Restoration of both the anatomic A/P alignment and the normal kinematic patterns of the knee should produce more normal neuromuscular firing patterns throughout the range of motion—as demonstrated in the original BCS design.10, 15

Satisfaction (Proprioception)

• Improving patients’ ease of activities of daily living can be expected due to the anticipated improvements of strength and stability

• Restoration of more normal neuromuscular firing patterns throughout the range of motion should improve a patient’s ability to perform the activities they are demanding—as demonstrated in the original JOURNEY BCS design.18, 19
Motion

Tibiofemoral (TF) kinematics

The kinematic patterns of the femur and tibia of a knee design have a direct impact on patients’ reported levels of satisfaction with the outcomes of their knee replacements.19, 20

**Extension**
- Femur internally rotated to achieve a natural anatomic screw-home position
- Minimal posterior femoral overhang in the sagittal plane (Proper A/P position)

**Mid-flexion**
- Femur external rotation to maximize quadriceps mechanism efficiency
- Virtual elimination of paradoxical motion to prevent mid-flexion instability

**Deep flexion**
- Femur remains externally rotated to retain maximal quadriceps efficiency
- Significant posterior femoral rollback occurs to gain clearance for deep flexion in high demand activities

JOURNEY BCS replicates the motion patterns of the normal, healthy knee

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![Diagram of knee motion patterns](image-url)
Patellofemoral (PF) kinematics

The kinematic pattern in the PF joint is critically important to decrease anterior knee pain post operatively and the associated revisions.\textsuperscript{22, 23, 24, 25}

- Provides improved contact which should improve wear performance\textsuperscript{22}
- Provides improved patella tracking which should minimize anterior pain\textsuperscript{22, 23}
- Provides more freedom of baseplate positioning without maltracking concerns\textsuperscript{26}

Flexion

The normal kinematic patterns of movement provide the correct environment to allow an anatomic, deep flexion performance.

- Engineered to provide for up to $155^\circ$ of flexion, following in the superior anatomic, high flexion kinematics proven in the first generation JOURNEY$^\text{®}$ BCS\textsuperscript{6, 9, 11, 13, 14, 28, 29}
Durability

Combining the award-winning materials of OXINIUM® Oxidized Zirconium and highly cross-linked polyethylene (XLPE), Smith & Nephew was able to create VERILAST™ Technology, a highly durable and long-lasting material combination. Using this technology, JOURNEY™ II TKA is designed to match the same high standards for wear performance.

Graph 3
VERILAST Technology vs Conventional Technology

<table>
<thead>
<tr>
<th>Volumetric wear rate (mm³/Mcycle)</th>
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</thead>
<tbody>
<tr>
<td>50</td>
</tr>
<tr>
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</tbody>
</table>

Mean volumetric wear rates (± std. dev.) of CoCr against conventional polyethylene (CPE), CoCr against crosslinked polyethylene (XLPE) and OXINIUM against XLPE.

Graph 4
Increased hardness

Graph 5
Lower friction

Increased hardness (GPa)

- OXINIUM Alloy: 12.1
- CoCr: 5.4

Coefficient of friction

- OXINIUM Alloy: 0.04
- CoCr: 0.08
Wear

- OXINIUM® Oxidized Zirconium is an advanced bearing material that combines the strength of metal with the wear resistance of ceramics.
- OXINIUM Technology is 4,900 times more resistant to abrasion than CoCr.
- OXINIUM Technology is more than twice as hard as CoCr (Graph 4).
- OXINIUM Technology has a coefficient of friction that is up to half that of CoCr (Graph 5).
- OXINIUM alloy femoral components are available for all JOURNEY® II Active Knee Solutions products.

Metal Sensitivity

We understand that no measurable nickel content is of immeasurable benefit to nickel-sensitive patients.

- OXINIUM Oxidized Zirconium, exclusively from Smith & Nephew, addresses the needs of nickel-sensitive patients by having less than 0.0035% nickel content, compared to a maximum content of 0.5% in cobalt chrome and 0.1% in titanium.
- Zirconium is a nearly inert material that has not reported to induce immune reactions.
Innovating for the lifecycle

Following on a rich history of partial knee arthroplasty and success of the JOURNEY® BCS design—which showed recovery of normal patterns of motion and high gains in flexion 6-13, 21, 27-28—Smith & Nephew has created a seamless, next generation family of partial and primary knee designs intended to restore patients to an unmatched level of function, motion and durability.

1972

Richards Manufacturing Company Marmor Uni
Richards Manufacturing collaborate with Dr. Leonard Marmor to commercially produce the first unicondylar knee on the market.

1988

GENESIS® Total Knee System
The introduction of the GENESIS TKS was a significant step in the evolution of the modern knee designs. It was the first system the "Address the Unexpected." With a single set of instruments and implants, virtually any interoperative situation could be handled. This technological advancement greatly simplified the process of TKA.
Designers: Dr. Ramon Gustillo, Dr. Jim Rand, Dr. Richard Laskin, Dr. James Howe, and Dr. Todd Swanson.

1997

GENESIS II Total Knee System
Launched as one of the first asymmetric femoral component designs, opening up the opportunity for less traditional knee designs. Over 1 million GENESIS II knees have been implanted globally.

The first OXINIUM alloy total knee implantation. Over the past 15 + years over 600k OXINIUM Alloy hips and knees have been implanted worldwide.

1995

GENESIS UNI
GENESIS UNI launched in collaboration with Professor Cartier and Dr. James Andrews has demonstrated to be one of the most clinically successful unicondylar knees on the market (94.5% at 10 years).41

1991

OXINIUM Oxidized Zirconium Patented
Patented the usage of Oxidized Zirconium with orthopaedic medical devices

2006

JOURNEY PFJ
The JOURNEY PFJ combines the clinically proven performance of its trochlear groove with powerful precision—the first completely instrumented JOURNEY PFJ system for greater reproducibility and ease of use. Designers: E. Lyle Cain, Jr, MD, Jeffrey R. Dugas, MD, Dr. John Neuman, FRCS, William B. Smith, MD,

2005

Engineering Materials Achievement Awarded to Smith & Nephew for use of OXINIUM Oxidized Zirconium. Established in 1969, this award recognizes an outstanding achievement in materials or materials systems relating to the application of knowledge of materials to an engineering structure or to the design and manufacture of a product. Smith & Nephew is only orthopaedics company to ever win this award. Past recipients include: GE, Dupont, IBM, Texas Instruments, Dow Corning, Northrup Grumman

2005

JOURNEY BCS
Using advanced biomechanical modeling technologies, the JOURNEY BCS was the first TKA to accurately replicate the normal kinematic patterns of the healthy knee joint. Over 60,000 JOURNEY BCS knees have been implanted around the world. ‘Most Significant New Product at AAOS’ (2006) Designers: Prof. Johan Bellemans, Dr. Jonathan Garino, Dr. Steven Haas, Dr. Michael Ries, and Prof. Jan Victor.

2005

LEGION® Revision Knee (RK)
The LEGION Revision Knee System was designed to strike a perfect balance by providing simple, efficient instruments specific to revision and a broad range of implant options to address even the most demanding surgeries. Combined with Oxidized Zirconium, LEGION Revision helps surgeons give their patients the potential for better outcomes with lower wear.
Leonard Marmor to commercially produce Richards Manufacturing collaborate with Dr. GENESIS™ Total Knee System.

1988

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1995

GENESIS UNI launched in collaboration with Professor Cartier and Dr. James Howe, (94.5% at 10 years).41 with Prof. Jan Victor and Dr. Ate Wymenga.

2005

JOURNEY UNI knee treats isolated compartmental disease with anatomic components coupled with simple, intuitive instrumentation for a streamlined, reproducible technique. Designers: Dr. William Bugbee, Dr. Donald Polakoff, Dr. Jonathan Young, Dr. Stuart Smith, Dr. Douglas Naudie, Dr. Paul Saenger, Dr. and Jerome Rubini

2008

Launched VERILAST® Technology

VERILAST Technology, a one-of-a-kind advanced bearing couple of OXINIUM Oxidized Zirconium with highly-crosslinked polyethylene formulation designed specifically for knees.

2007

PLUS Orthopedics

Smith & Nephew purchased the Swiss company PLUS Orthopedics. This added the PLUS SOLUTION knee family to the portfolio. TC-PLUS’ PRIMARY, TC-PLUS REVISION, and RT-PLUS’ REVISION. The PLUS Knee family is developed and manufactured in Switzerland and offers a seamless system; from Primary – Complex Primary – Revision – Hinge Knee.

2007

JOURNEY DEUCE

Revolutionary approach to addressing medial femoral and patella-femoral disease in monolithic component. The lessons gained from experiences have allowed advanced kinematic evaluations. Designers: Dr. Lindsey Rolston and Dr. Gerard Engh.

2009

VISIONAIRE® Patient Matched Instrumentation

In 2009 Smith & Nephew globally launched the foundation of its patient specific solutions, VISIONAIRE Patient Matched Cutting blocks. Smith & Nephew was the first company to launch patient matched technology developed and manufactured completely in house.

2008

JOURNEY UNI

JOURNEY UNI knee treats isolated compartmental disease with anatomic components coupled with simple, intuitive instrumentation for a streamlined, reproducible technique. Designers: Dr. William Bugbee, Dr. Donald Polakoff, Dr. Jonathan Young, Dr. Stuart Smith, Dr. Douglas Naudie, Dr. Paul Saenger, Dr. and Jerome Rubini

2010

Acquisition of LifeMod

Smith & Nephew announces the acquisition of LifeModeler, Inc. (LMI), the leading provider of biomechanical human body simulation tools and services. LMI’s groundbreaking software shortens the time taken to develop new products by enabling the evaluation of innovations in a virtual model of the human body. New orthopaedic products can be tested and validated faster, further and more cost effectively prior to the production of a physical prototype.

2012

LEGION® Hinge (HK)

LEGION Hinged Knee is launched as an extension of the clinically successful LEGION Total Knee System. Its kinematic and bone sparing design not only alleviates patients’ symptoms, but also restores an almost natural knee function. Coupled with its ease of use by allowing surgeons to seamlessly transition intraoperatively from a constrained revision implant to a hinged assembly, it makes knee salvage, knee rescue.

2012

JOURNEY II BCS

The next generation of normal function, motion and durability. More normal kinematics and function-strength, stability and higher flexion achieved through the unique features of the JOURNEY II BCS system; normal shapes, normal position and normal motion. Designers: Prof. Johan Bellemans, Dr. Jonathan Garino, Dr. Steven Haas, Dr. Michael Ries, and Prof. Jan Victor, Dr. Mark Snyder and Dr. Fred Cushner.

2013

VISIONAIRE Technology and Patient Specific Logistics

in 2013 Smith & Nephew launched its first phase of Patient Specific Logistics with the Universal Instrument Trays. This industry leading initiative allows for Smith & nephew to provide “just in time logistics” where instruments specific to each patient including size and hand are provided for each surgery helping to reduce hospital costs and improve operating room efficiency.

2014

JOURNEY II CR

Designed to be the first kinematically correct cruciate retaining TKA on the market designed in collaboration with Professor Johan Bellemans, Dr. David Drucker, Dr. Alois Franz, Dr. Murali Jasty, Dr. Gerald Jerry, Dr. Michael Ries, Mr. Neil Thomas, Dr. Alfred Tria, Professor Jan Victor and Dr. Ale Wymenga.
References


15. Lester DK and Shantharam R. Objective Sagittal Instability of CR-TKA by Functional EMG During Normal Walking. AAOS. 2012; Presentation No. 810.


37. Ref: Smith & Nephew OR-12-129

38. Smith & Nephew, Inc. 7135 Goodletts Farm Parkway Cordova, TN 38016 USA

39. Telephone: 1-800-562-5580

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