



# *Evolution*®

## MEDIAL-PIVOT KNEE SYSTEM

DESIGN RATIONALE

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# Introduction

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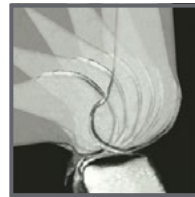
The MicroPort medial-pivot knee system now stands on over 20 years of clinically demonstrated history with its first to market medial-pivot design that was built on the latest kinematic evidence of the natural stability and motion of the knee.<sup>1,2</sup> Its innovative design aims to restore function by replicating natural motion and AP stability and to address some of the common problems seen with traditional designs, such as anterior knee pain and quadriceps avoidance.

It has been clinically established that patients are more satisfied with the MicroPort medial-pivot design when compared to more traditional knee designs.<sup>1</sup> One of the primary reasons for these dramatic results is the stability provided through the high tibiofemoral conformity in the medial compartment and the natural mobility provided in the lateral compartment. This innovative design has shown 95% patient satisfaction with 98.8% survivorship at 17 years.<sup>1</sup>

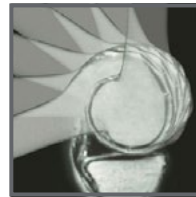
Utilizing the Evolution® medial-pivot knee system's 1:1 conformity (medial ball-in-socket) without constraint (lateral mobility), the quadriceps is not required to activate to prevent the femur from sliding forward on the tibia, as seen with traditional implant

designs. This enhanced quadriceps efficiency minimizes the force acting on the extensor mechanism and allows for faster functional recovery and higher forgotten joint scores.<sup>2,3,17</sup>

## IMAGES OF THE NORMAL KNEE<sup>16</sup>



Mobile Lateral  
Compartment



Stable Medial  
Compartment



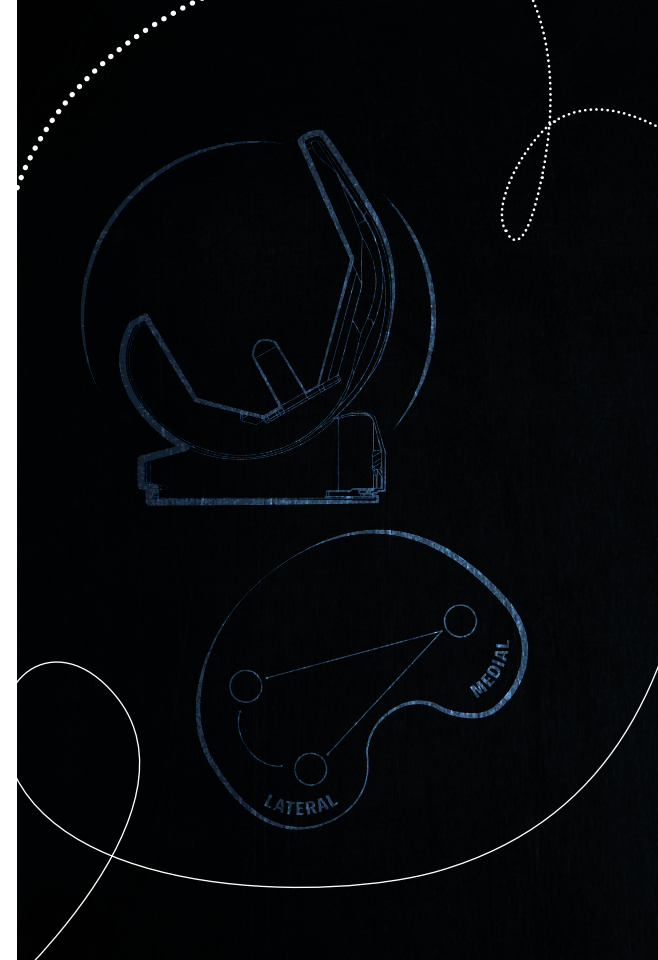
**98.8%**

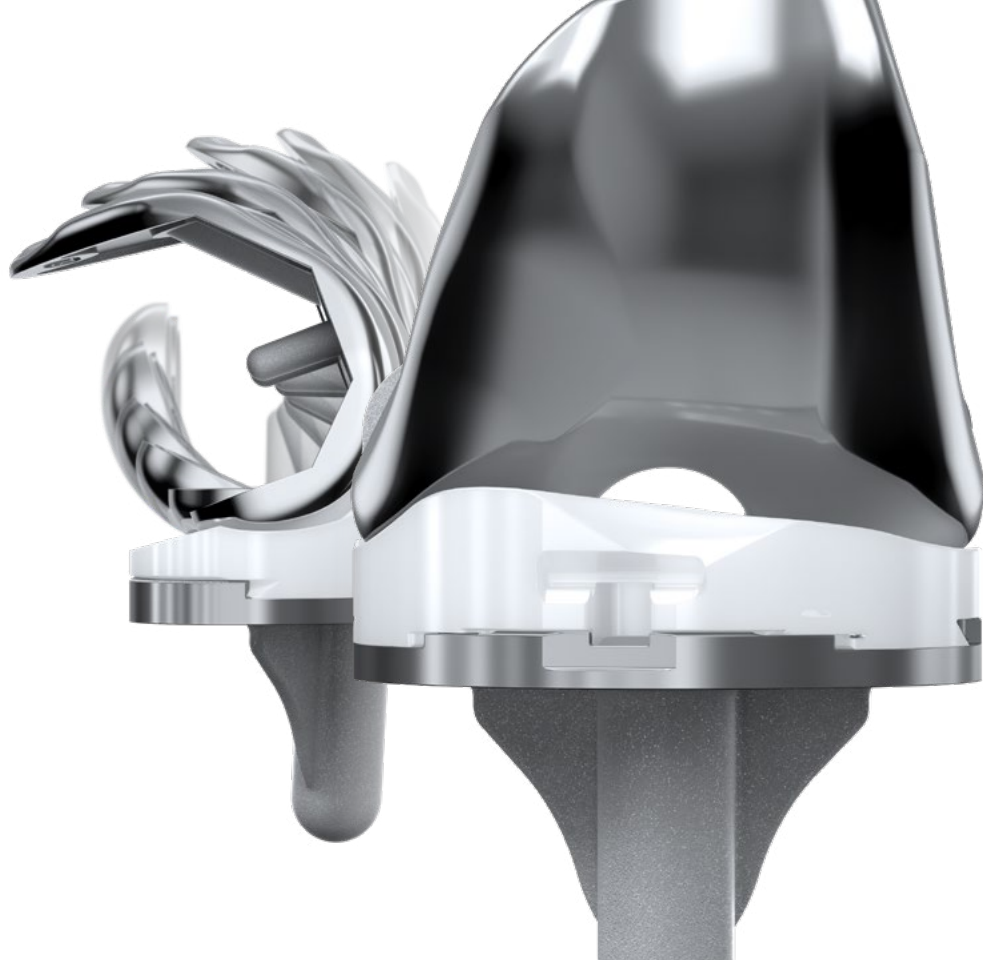
Survivorship  
at 17 years!

**INNO  
VATION  
THAT  
LASTS**

## Linking kinematic theories to implant design

In order to understand the functional outcome differences produced by various implant designs, it is critical to first examine the thought progressions that led to these designs. Many of today's popular designs still adhere to outdated kinematic theories that incorporate less conforming tibiofemoral articulation to produce rollback. However, instead of producing rollback, these designs have been shown to produce instability and limited function.<sup>5-7</sup>





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The Evolution® Knee System  
restores function by  
replicating the natural AP  
stability and medial-pivot  
motion of the knee.

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# Traditional implant designs *and the cause of instability and poor satisfaction*

Following decades of improvement to technique and implant design, approximately 20% of knee replacement patients continue to remain unsatisfied.<sup>8</sup>

Many of today's popular implant designs built with less tibiofemoral conformity can potentially produce

anterior sliding of the femur on the tibia. Much of this dissatisfaction can be explained through functional limitations caused by instability—the underlying cause of limitations such as anterior knee pain and loss of quadriceps performance.



Approximately  
**25%**  
of all revisions  
in TKA are for  
instability  
following  
surgery.<sup>9-11</sup>

## Consequences of instability

### Anterior knee pain

As the femoral component of a traditional implant design slides forward in early flexion, the added force causes the extensor mechanism to attempt to stabilize the knee during activities. ***This force eventually causes pain by tiring the extensor mechanism.***

### Loss of quadriceps performance

As the extensor mechanism tires, patients begin using a quadriceps avoidance gait to adapt to the weakening extensor, which can lead to pain.<sup>12</sup>

In order for patients to compensate for the instability and pain, the quadriceps must continually contract in order to prevent the femur from sliding forward. ***Patients ultimately waste much of their quadriceps performance attempting to compensate for this instability.***

### Slower functional recovery

Lack of functional stability can hinder ability to get back to daily activities. Patients can feel less comfortable during activities such as moving up or down stairs and getting in and out of chairs.



***Sliding forward of the femur on the tibia.***



The  
Evolution®  
medial-pivot knee  
replicates the natural  
stability and motion  
of the knee delivering a  
functionally-restorative  
design that offers surgeons  
an innovative solution to  
problems such as instability,  
anterior knee pain,  
and functional  
limitations.<sup>5-7</sup>



## Stability without compromise

Promoted through high medial conformity and constant radius spherical condyles.<sup>5-7</sup>

## Faster functional recovery<sup>2</sup>

Increased flexion and enhanced quadriceps efficiency achieved through longer constant flexion radius with more posterior, medial dwell point.

Patients who underwent total knee arthroplasty (TKA) with the medial-pivot knee scored significantly better on the Forgotten Joint Score (FJS) than those who underwent a TKA with a modern posterior stabilized (PS) knee, particularly with regard to deep knee flexion and stability of the prosthesis.<sup>3</sup>

## 20 year medial-pivot clinical history

- 98.8% survivorship at 17 years and 95% patient satisfaction<sup>1</sup>
- Over 600,000+ implanted worldwide<sup>2</sup>
- Full continuum of care with medial-pivot design across primary & revision

# *Stability without compromise*

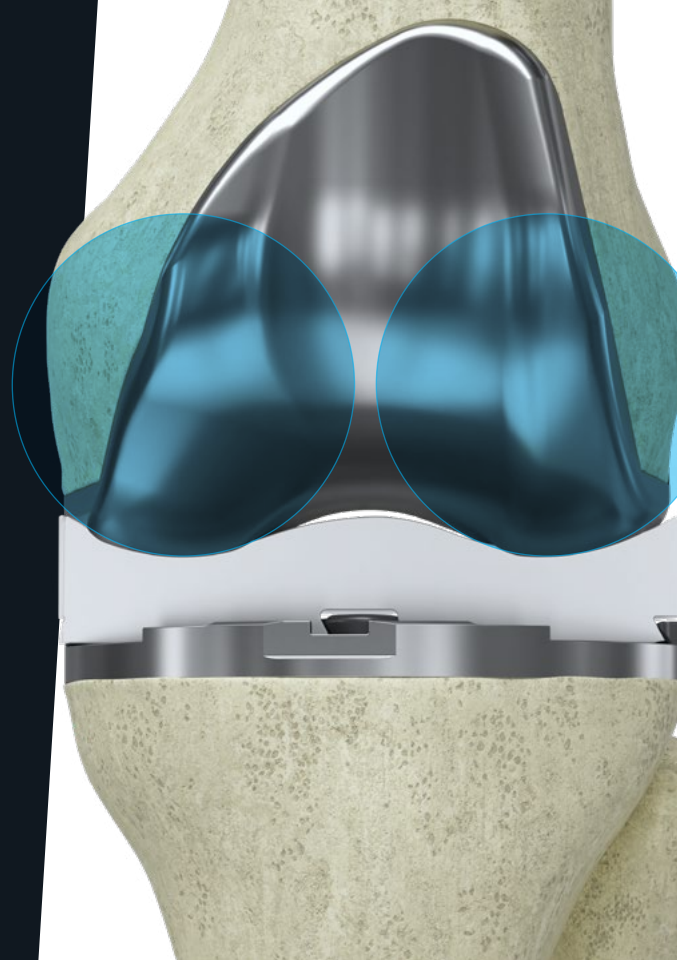
## High 1:1 conformity

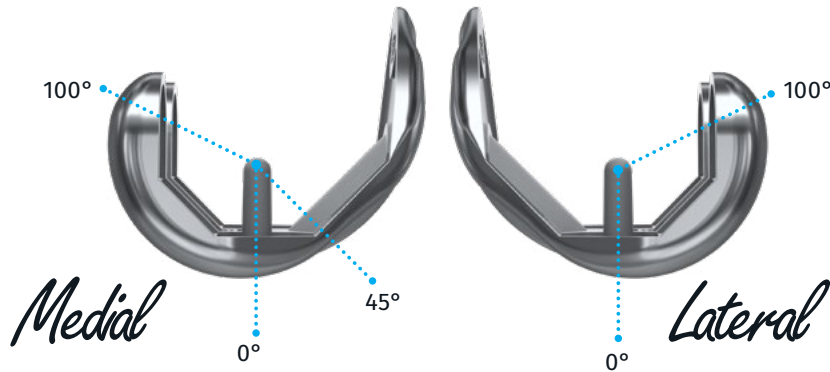
- Medial ball-in-socket articulation.
- Formulated to maximize stability throughout the range of motion and provide high flexion.<sup>2,13</sup>
- High medial conformity creates the stability provided by the natural bony geometry and soft tissue.

## Constant Radius

Constant radius knee replacements can exhibit higher clinical function when compared with multi-radius knee replacements.<sup>14</sup>

Through medial ball-in-socket articulation, coupled with lateral mobility, the Medial-Pivot Knee System has been formulated to maximize stability throughout the range of motion.<sup>2,13</sup>





Innovative knee design with spherical geometry in both sagittal and coronal



Medial compartment of the Evolution® medial-pivot knee flexed at 30°.

**Natural medial stability in the Evolution® medial-pivot knee substitutes for the ACL, PCL and bony geometry and allows the quadriceps to perform like normal.<sup>13</sup> Enhancing quadriceps efficiency may contribute to increased proprioception and more normal feeling following surgery.<sup>5</sup>**

# *Faster, functional recovery*<sup>28</sup>

## Natural feeling knee movement

- The high anterior and posterior lips on the Evolution® tibial insert substitute for both cruciates.
- AP stability can be improved through implant design by preventing AP motion through conformity of the femoral and tibial components.<sup>12</sup>
- Natural motion and stabilizing structures of the normal knee are replicated in the Evolution® knee system.

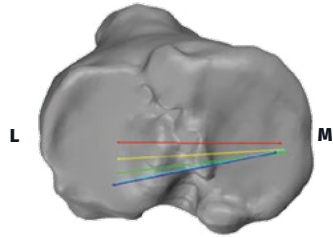
## Increased Flexion Potential

- Larger posterior condylar offset and posterior tibial dwell point allow for a more posterior position of the femur on the tibia.
- Posterior femur positioning facilitates deep flexion angles.
- Clinical evidence has shown that the medial-pivot design achieves equal or higher degrees of flexion than traditional posterior stabilized (PS) knee design, with an average of 120°<sup>3</sup>

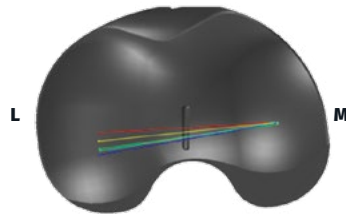
## Higher Forgotten Joint Score

- Patients who underwent total knee arthroplasty (TKA) with the medial-pivot knee scored significantly better on the Forgotten Joint Score (FJS) than those who underwent a TKA with a modern PS knee, particularly with regard to deep knee flexion and stability of the prosthesis.<sup>3</sup>

FIGURE 1



Normal



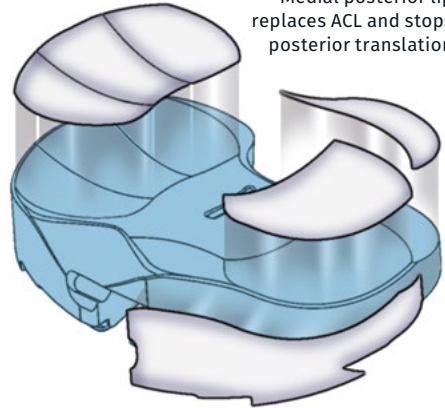
Evolution® medial-pivot

**FIGURE 1:** Contact points from full extension to full flexion (115°) evaluated for the normal knee and the Evolution® medial-pivot Knee system.

**FLEXION ANGLES:**

0° 30° 60° 90° 115°

Lateral menisci path allows for 15° of motion



Medial posterior lip replaces ACL and stops posterior translation

Medial anterior lip replaces PCL and stops anterior translation

Medial meniscal "socket" provides stability

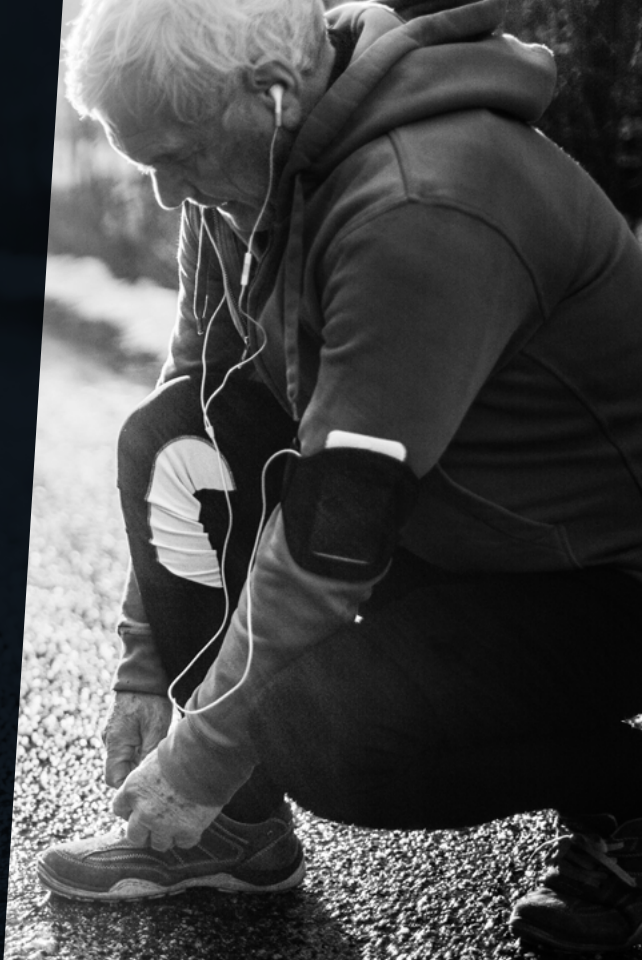
A clinical study found patients felt more normal following surgery due to the stability, enhanced quadriceps efficiency, and increased flexion potential.<sup>2,17</sup>

# Patient satisfaction

## Patients can feel the difference in stability<sup>18</sup>

This bilateral patient preference study sought to examine if patients have higher satisfaction with one prosthesis over another.

- 440 patients underwent bilateral TKA using a different prosthesis on each side.
- Five knee prostheses were used: ACL-PCL Retaining, Posterior Cruciate-Retaining (CR), Medial-Pivot (MP), Mobile-Bearing (MB) and Posterior-Stabilized (PS).
- The study found patients who underwent bilateral staged TKA were more likely to prefer retention of the ACL and PCL or substitution with the MP Prosthesis.

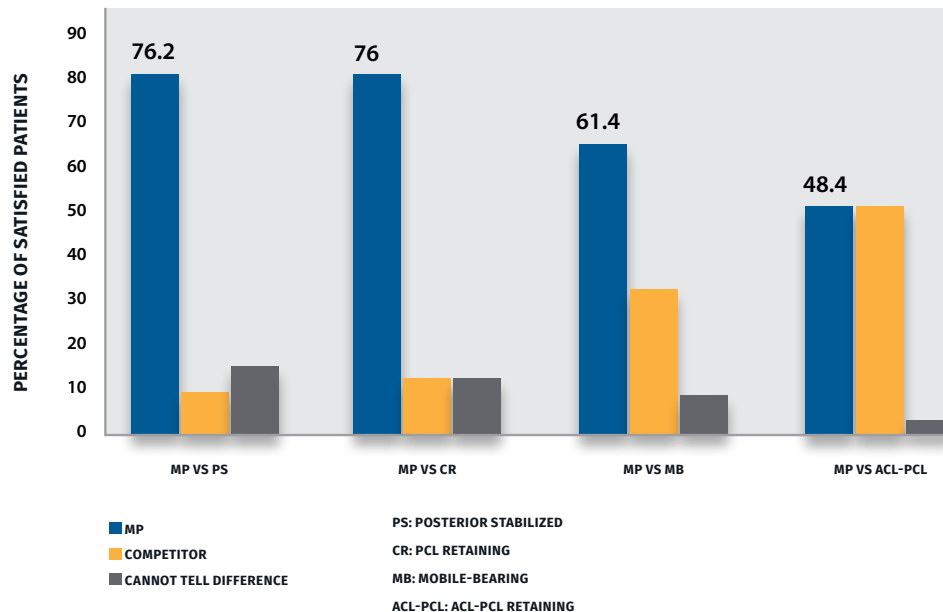




## A long-term clinical outcome of the medial-pivot knee arthroplasty system<sup>1</sup>

- 93% experienced very good to excellent pain relief.
- Recovery of function was also very good to excellent with 94% of the patients being able to perform regular activities.
- 78% of them reported that they were able to perform age-appropriate heavy manual work or take part in sport activities, at a mean postoperative period of six months.
- For 95% of the cases, surgery fulfilled patients' expectations at an excellent or a very good level.
- The ROM was improved from 85° to 120° on average.

MEDIAL-PIVOT VS. COMPETITIVE KNEE DESIGNS<sup>18</sup>

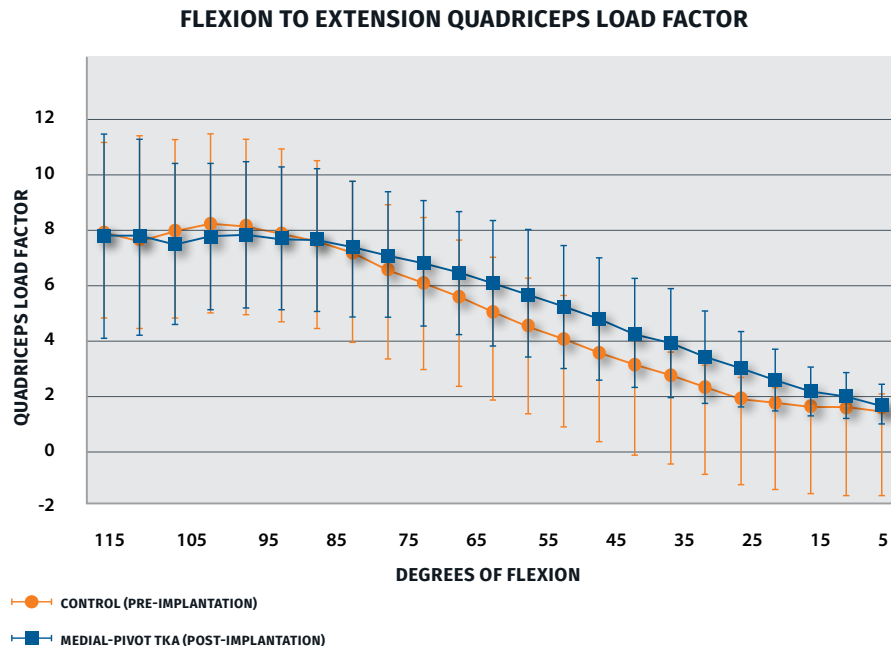


## Similar quadriceps efficiency to control group

One in vitro study of quadriceps efficiency following TKA with the Evolution® medial-pivot Knee system demonstrated a similar quadriceps load factor to the pre-implantation control group.<sup>17</sup>

### This similarity suggests:

- Functional performance is affected by AP stability and can potentially lead to faster rehabilitation.<sup>19</sup>
- The combination of the medial spherical radius and conformity of the medial tibial insert provides a constant moment arm on which the extensor mechanism to act.<sup>17</sup>

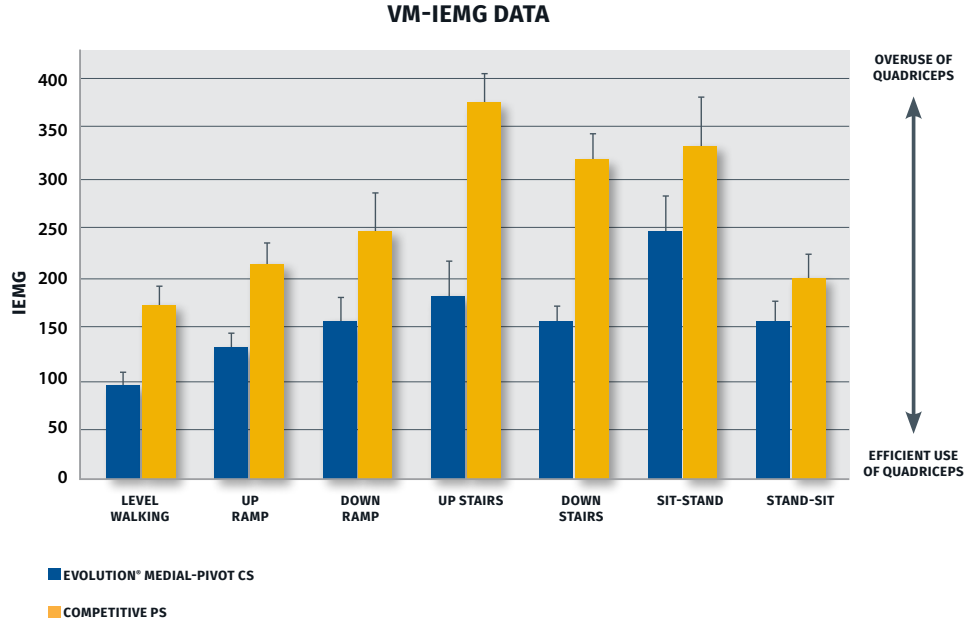


## Enhanced quadriceps efficiency following TKA

The graph below demonstrates, through EMG data of the vastus-medialis (VM), the enhanced quadriceps efficiency found in patients with an Evolution® medial-pivot CS Knee over that of patients with a traditional PS Knee.<sup>5</sup>

**Patients with improved quadriceps efficiency and AP stability may experience:**

- More normal feeling.
- Improved patellofemoral mechanics.
- Superior single-leg weight-bearing flexion performance.<sup>18</sup>



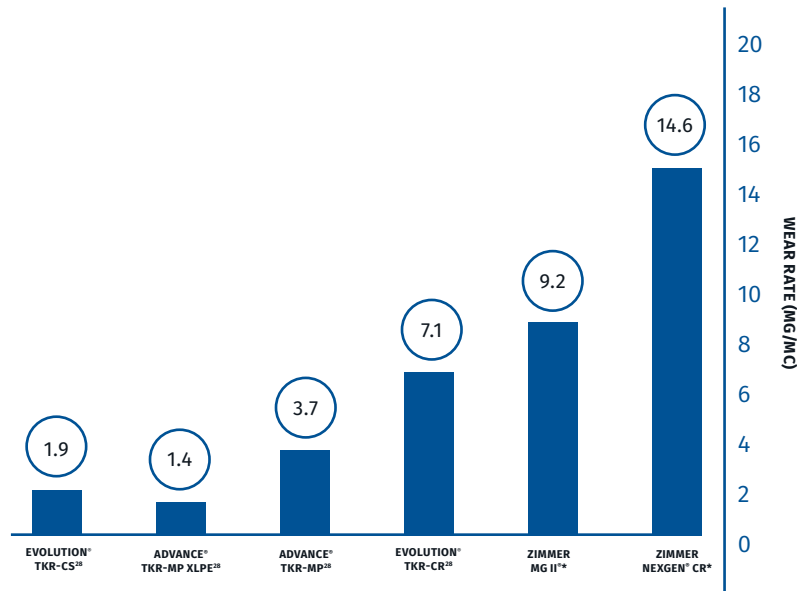
# Wear limiting design

## Minimized contact stresses

- High contact throughout the range of motion (ROM) to minimize contact stresses.<sup>2</sup>
- In vitro wear assessment data demonstrates that implant design may be more important than bearing materials. **FIGURE 2**

\*WEAR DATA RETRIEVED FROM LITERATURE SOURCES.<sup>20,21</sup>  
WEAR TESTING WAS NOT PERFORMED BY MICROPORT ORTHOPEDICS.

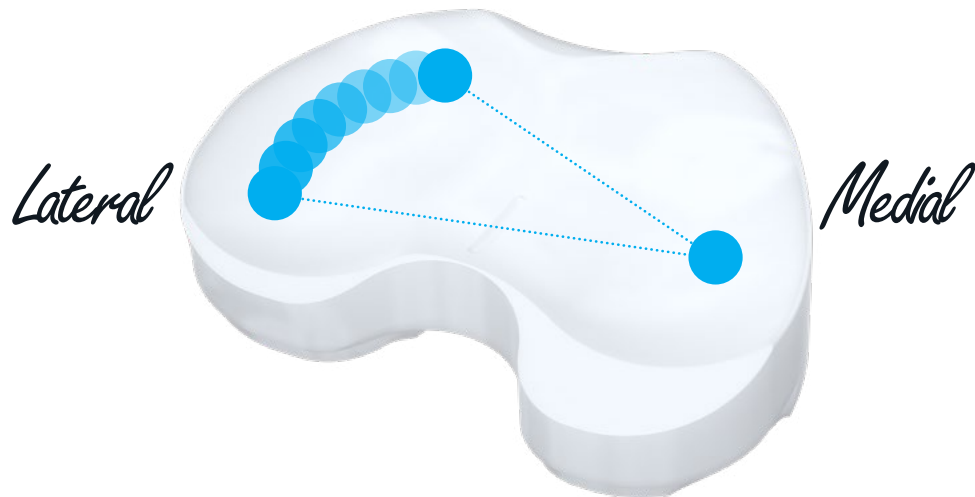
**FIGURE 2 | WEAR RATES FOR EVOLUTION<sup>®</sup>, ADVANCE<sup>®</sup> AND TWO ZIMMER SYSTEMS**



**FIGURE 2**

**Evolution® medial-pivot Knee system exhibits a repeatable motion.**

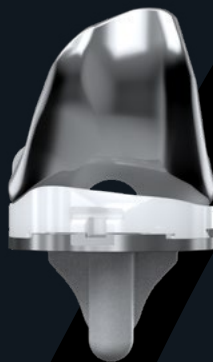
- Replicates the kinematics of the natural knee.
- Resists multi-directional motion often occurring in traditional knee replacements, which some studies have linked to increased wear.<sup>6,22-24</sup>



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Fueled by innovation  
primary through revision

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**EVOLUTION®**

The next Evolution® of the  
Advance® medial-pivot knee



**BIOFOAM®**

Tibia and porous femur for  
cementless fixation



**NITRX™**

TiNbN-coated knee





**PRIMARY STEMMED CS**

Boxless stemmed  
primary femur



**REVISION TIBIA**

Medial-pivot revision Tibia



**REVISION CCK®**

CCK femur and revision tibia



**REVISION STEMMED CS**

Boxless stemmed revision  
femur and tibia

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*Full Function, Faster®*



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