Let's Talk
Science...

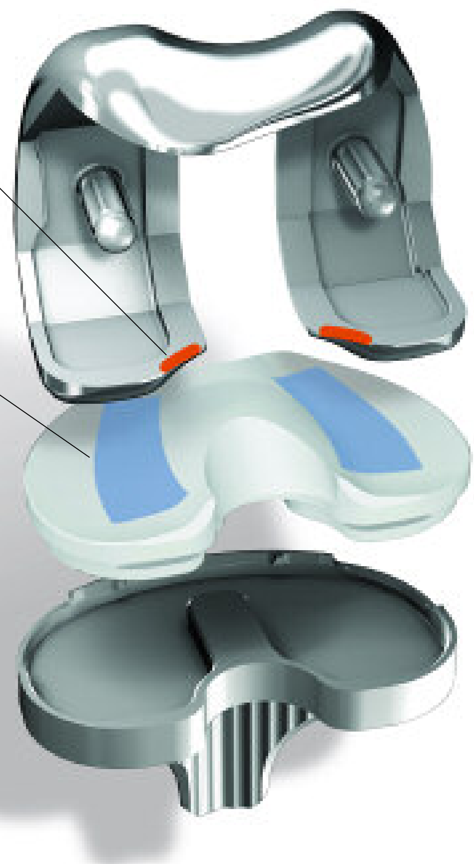
The Science of:

- **Motion**[13]
- **Fit**[6]
- **Wear**[1]

Triathlon®
Knee System

The Science of Increased Motion™

High flexion knee system designed for mobility with stability through 150 degrees of motion.



Flared Posterior Condyles

- Open design accommodates 20 degrees of internal/external rotation throughout the range of motion.[7]

Rotary Arc Insert

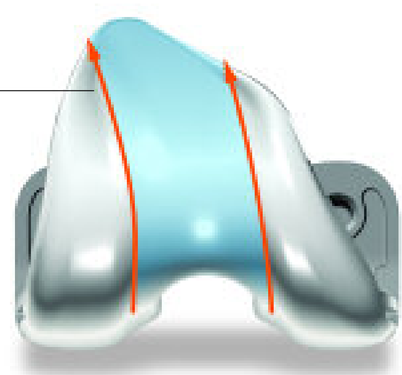
- Precision-machined surface facilitates internal/external rotation

Anatomic Radius (10° – 110°)

- Designed to maintain collateral ligament stability throughout the range of motion.[8]
- Centered at the transepicondylar axis - the optimal flexion axis of the knee.[9]

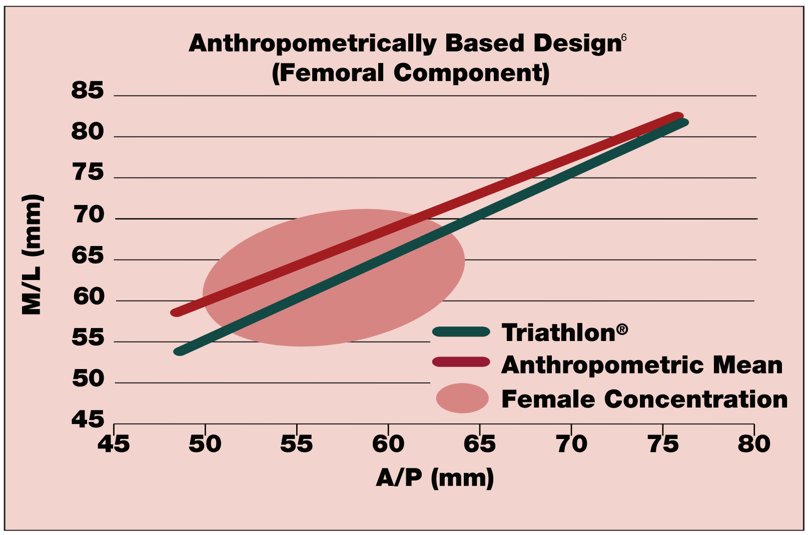
Anatomic Patellofemoral Track

- The Triathlon® Knee patellofemoral track shares the same design as preceding Stryker® total knee systems, bringing over a decade of excellent clinical performance and the industry's lowest revision rate (0.3%)[10] to date to this knee system.



The Science of Better Fit™

Designed with a wide range of sizing options, based on the anatomical differences of men and women.[6]

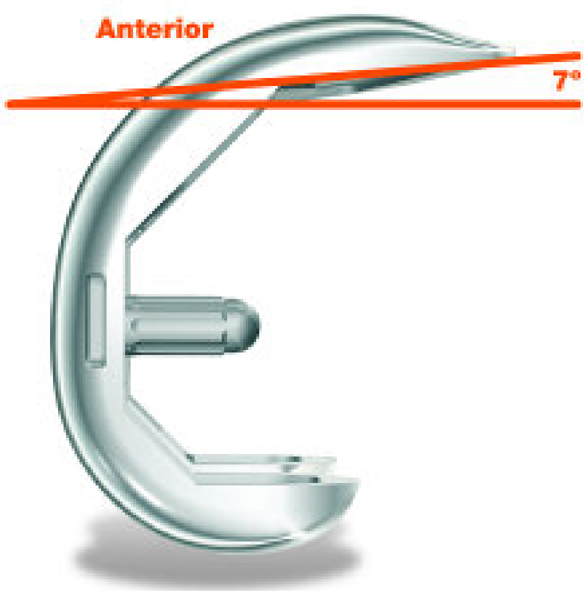


The Triathlon® Knee System addresses smaller anatomies, often found in female patients, heavily concentrated in the region shown, while still accommodating larger male patients.

- Broad range of size offerings are based on an anthropometric measurement study[6] for improved interplay between implant geometry and anatomic structure for women and men.
- The Triathlon® design incorporates a variable aspect ratio to adequately fit the female anatomy while still accommodating the male population.[6]
- The many design aspects of the implant accommodates surgical realities.

7-Degree Anterior Flange

- The unique 7-degree anterior flange design of the Triathlon® Knee System is designed to provide the flexibility to downsize the femoral component while avoiding the incidence of notching. This feature culminates in the potential to provide patients with a more customized fit.



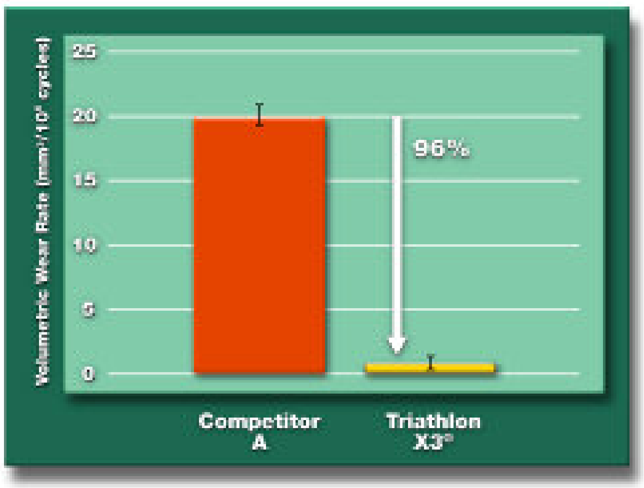
The Science of Reduced Wear™

High performance through improved design kinematics combined with X3® Advanced Bearing Technology.[1]

The Triathlon® Knee System is designed to reduce rotational stresses, increase overall contact area, and minimize backside wear.

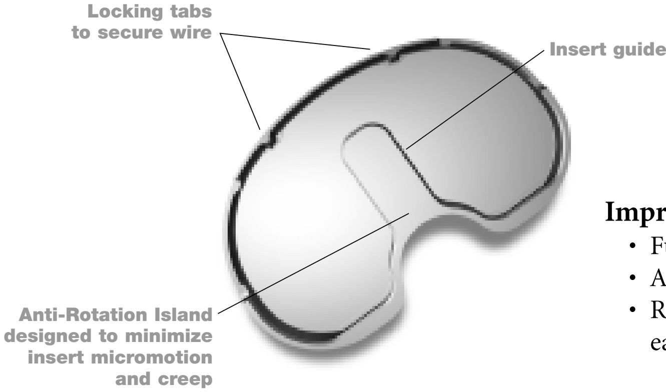
- Through the Rotary Arc design, anatomic radius, and flared posterior condyles, the Triathlon® Knee System balances conformity with constraint to mimic natural knee kinematics and the potential for enhanced wear properties.[2,3,7]

Wear Test Results: Triathlon® Knee System with X3® versus Competitive Premium Bearing Technology[1]



X3® Advanced Bearing Technology

- **Structural Contact Fatigue Strength better than conventional polyethylene[11]**
- **Improved Wear Performance[2,3]**
- **Oxidation Resistance[4,5]**
  Same as virgin polyethylene



Improved Locking Mechanism Design

- Full periphery locking rim and locking wire.
- Anti rotation island.
- Reduce micromotion and promote ease of insertion.[12]

The Triathlon® Knee System is designed to meet patients' expectations for Lifestyle Recovery™. The intuitive and evolutionary design is predicated on the worldwide clinical success of millions of Stryker knee implantations. The Triathlon® Knee System is designed to provide patients with increased motion , better fit and reduced wear.

References:

1. Stryker Orthopaedics Test Report: RD-06-013.
2. Stryker Orthopaedics Triathlon® CR Tibial Inserts made from X3® UHMWPE, 5530-G-409 show a 68% reduction in volumetric wear rate versus the same insert fabricated from N_2\Vac gamma sterilized UHMWPE, 5530-P-409. The insert tested was Size 4, 9 mm thick. Testing was conducted under multiaxial knee simulator (multi-station MTS knee joint simulator [a]) for five million cycles using appropriate size CoCr counterfaces, a specific type of diluted calf serum lubricant and the motion and loading conditions, representing normal walking, outlined in ISO/DIS 14243-3. Volumetric wear rates were 17.7 ± 2.2 $mm^3/10^6$ cycles for standard polyethylene inserts and 5.7 ± 1.5 $mm^3/10^6$ cycles for test samples. Test inserts were exposed to a gas plasma sterilization process. In vitro knee wear simulator tests have not been shown to quantitatively predict clinical wear performance.
   [a] A. Essner, A. Wang, C. Stark and J. H. Dumbleton, "A simulator for the evaluation of total knee replacement wear," 5th World Biomaterials Congress, Toronto, Canada, May, 1996, pg 580.
3. Stryker Orthopaedics Triathlon® PS Tibial Inserts made of X3® UHMWPE, 5532-G-409 show a 64% reduction in volumetric wear rate versus the same insert fabricated from N_2\Vac gamma sterilized UHMWPE, 5532-P-409. The insert tested was Size 4, 9 mm thick. Testing was conducted under multiaxial knee simulator (multi-station MTS knee joint simulator) for five million cycles using a size 7 CoCr counterfaces, a specific type of diluted calf serum lubricant and literature or fluoroscopy based motion and loading conditions representing stair climbing [b,c]. Volumetric wear rates were 3.6 ± 0.61 $mm^3/10^6$ cycles for standard polyethylene inserts and were 1.3 ± 0.44 $mm^3/10^6$ cycles for test samples. Test inserts were exposed to a gas plasma sterilization process. In vitro knee wear simulator tests have not been shown to quantitatively predict clinical wear performance.
   [b] R. Riener, M. Rabuffetti and C. Frigo, "Stair ascent and descent at different inclinations", Gait and Posture 15: 2002, pp. 32-44.
   [c] JB. Morrison, "Function of the knee joint in various activities", Bio-medical Engineering, 4: 1969, pp. 573-580.
4. X3® UHMWPE maintains mechanical properties after accelerated oxidative aging. No statistical difference was found for Tensile Yield Strength, Ultimate Tensile Strength and Elongation as measured per ASTM D638 before and after exposure to ASTM F2003 accelerated aging (5 Atmospheres (ATM) of oxygen at 70°C for 14 days). Tensile Yield Strength was 23.5 ± 0.3 MPa and 23.6 ± 0.2 MPa, Ultimate Tensile Strength was 56.7 ± 2.1 MPa and 56.3 ± 2.3 MPa, and Elongation was 267 ± 7% and 266 ± 9% before and after accelerated oxidative aging, respectively.
5. X3™ UHMWPE resists the effects of oxidation. No statistical difference was found for Tensile Yield Strength, Ultimate Tensile Strength, Elongation, Crystallinity and Density as measured per ASTM D638, D3417 and D1505 before and after ASTM F2003 accelerated aging (5 ATM of oxygen at 70°C for 14 days). Tensile Yield Strength was 23.5 ± 0.3 MPa and 23.6 ± 0.2 MPa, Ultimate Tensile Strength was 56.7 ± 2.1 MPa and 56.3 ± 2.3 MPa, Elongation was 267 ± 7 % and 266 ± 9%, Crystallinity was 61.7 ± 0.6% and 61.0 ± 0.5%, and Density was 939.2 ± 0.1 kg/m3 before and after accelerated oxidative aging, respectively.
6. Hitt, K., et al., "Anthropometric Measurement of the Human Knee: correlation of to the Sizing of Current Knee Arthroplasty Systems," JBJS, Vol. 85-A, Supplement 4, 2003.
7. Stryker test data RD-03-041 and RD-04-027.
8. Stryker initiated Dynamic Computer Simulations of Passive ROM and Oxford Rig Test, Stephen Piazza, 2003
9. Churchill, D.L., Incavo, S.J., Johnson, C.C., Beynnon, B.D., The Transepicondylar Axis Approximates the Optimal Flexion Axis of the Knee, Clinical Orthopaedics. Nov. 1998 (356): 111-8.
10. Robertson, O., Knutson, K., Lewold, S., Lidgren, L., The Swedish Knee Arthroplasty Register, Outcome with Special Emphasis on 1988-1997. Department of Orthopedics, University Hospital.
11. Contact fatigue testing was conducted on accelerated aged sequentially crosslinked and annealed (X3®) UHMWPE and control materials. Testing involved translating a 22mm CoCr femoral head across 5 mm thick samples at 0.5 Hz under a 200 N load for a contact stress of 62 MPa. Control materials were nitrogen packed and gamma-radiation sterilized and air packed and gamma-radiation sterilized UHMWPE's. X3® samples were unsterilized. All contact fatigue samples were ASTM F2003 accelerated aged (5 ATM of oxygen at 70°C for 14 days). Testing induced cracking in control materials in as little as 0.5 million cycles while proposed material samples showed no signs of pitting, cracking (surface or subsurface) after 5 million cycles. Control material cracks progressed to gross material loss (delamination). The results of the in-vitro delamination tests have not been shown to correlate with clinical delamination mechanisms.
12. Stryker Test Report. Multi-Axis Dynamic Fatigue Test MTP101.0-02.
13. Greene, K.A., Range of Motion: Early Results from the Triathlon® Knee System, Stryker Literature Ref # LSA56., 2005.

A surgeon must always rely on his or her own professional clinical judgment when deciding to use which products and/or techniques on individual patients. Stryker is not dispensing medical advice and recommends that surgeons be trained in knee implant surgeries before performing any knee surgeries.

The information presented in this brochure is intended to demonstrate the breadth of Stryker product offerings. Always refer to the package insert, product label and/or user instructions before using any Stryker product. Products may not be available in all markets. Product availability is subject to the regulatory or medical practices that govern individual markets. Please contact your Stryker representative if you have questions about the availability of Stryker products in your area.

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