The ATTUNE® Knee System has demonstrated significant improvements in both clinical and value-based healthcare measures\textsuperscript{1,2,3}.

- **Improved patient reported outcome measures** compared to other leading knee systems that were tested.\textsuperscript{1}
- **Survivorship estimate is 98.7% at four years** in the National Joint Registry for England, Wales, Northern Ireland and the Isle of Man Implant Summary Report\textsuperscript{2}.
- **39% lower odds of patient discharge to a skilled nursing facility** for ATTUNE Knee patients vs patients who received TKA with a Triathlon\textsuperscript{™} Knee, according to the results of a large U.S. hospital administrative database review.\textsuperscript{3}

Polyethylene (PE) wear was historically the leading cause for knee revision, today aseptic loosening is the leading cause.

Now that PE wear has been markedly reduced, the most prevalent causes of revision are infection and aseptic loosening, with evidence indicating aseptic tibial loosening being the most common cause overall for revisions after two years.\textsuperscript{2,4,5}

Lipids and Motion: DePuy Synthes sought to develop a stronger understanding of the causes of aseptic loosening.

DePuy Synthes leveraged several studies including the 2014 study by Billi & Schmalzried et al.\textsuperscript{6} This study found that lipids/marrow are major factors that can reduce the fixation strength of the cement-tibial bone interface.

“Fat contamination of the metal-cement interface reduced the interface strength to practically zero (-99% (p=0.003), Simplex\textsuperscript{®}, and -94% (p=0.030) Palacos).”\textsuperscript{6}

DePuy Synthes subsequently conducted extensive cadaveric research, concluding that fluid/lipids infiltration is more influential during the surgical procedure than previously represented in the literature.\textsuperscript{8,9,10}

A significant reduction of implant/cement bond strength was due to the combined effect of lipid/marrow and intra-operative motion.\textsuperscript{7}

On average, there was a 2490 N reduction of pull-out strength when motion was introduced during the cement curing process, when averaged across 4 different designs.\textsuperscript{8}

Effect of Simulated Intra-Op Motion – Cadaver (Cement on Bone Only)\textsuperscript{9}

There is an Opportunity To Improve this!
Introducing the ATTUNE S+ Technology

The tibial base with ATTUNE S+ Technology includes added features designed to provide greater residual pull off strength under a range of simulated intra-operative conditions and the presence of lipid infiltration and motion.

The ATTUNE S+ Technology is designed to enhance tibial fixation with its innovative combination of macrolock features and a microblast surface finish on the tibial base.

**Macrollock + Microblast**
*Designed to Enhance Fixation*

**Macrolock**
- Four additional pockets (45° Undercuts)
- Provides a macrolock between cement-implant interface

**Microblast**
Optimized microblast to inhibit lipid infiltration across surface
The Macrolock

These additional features provide a macrolock between the cement - implant interface.

![Image of Macrolock](image)

**Four cement pockets; designed to provide additional macro mechanical fixation with cured cement.**

**45 degree undercuts; macro geometry designed to provide a macrolock between cement-implant interface.**

**The Microblast**

The microblast feature is focused on the surface finish on the underside, or distal aspect, of the implant. Increasing surface roughness of a metal implant has the potential to increase cement-implant interdigitation AND reduce infiltration of fluids into the cement-implant interface.

![Image of Microblast](image)

**Surface Roughness (Ra): The quantification of how rough (high Ra) or smooth (low Ra) a surface is. Calculated as a mean of the micro peak and trough heights.**

**The ATTUNE S+ Technology finishing process increases the surface roughness compared with other, DePuy Synthes clinically proven, tibial tray designs that were tested.**

To create baseline figures for pull-out strength without motion and lipids as indicated by the blue bars, we compared the ATTUNE FB Knee to SIGMA® FB Knee and multiple predicate FB devices. The ATTUNE FB Knee compared positively to the predicate devices that were tested.

Subsequently, we tested these same designs under simulated motion with lipids. As you can see with the red bars, the fixation strength of all designs was impacted.

In the bar graph to the right taken from a research study published at EFORT 2017 in Vienna, “A New Tibial Fixation Concept” referred to the Attune S+ Technology. The design statistically significantly improved pull-out strength compared to other tested designs—both with and without lipid and simulated intra-operative motion.
The ATTUNE Knee System continues to grow its portfolio to provide surgeons with a broad range of solutions for their patients.

1. Hamilton W.G., Brenkel, I., Clatworthy, M., Dwyer, K., Himden, S., Lesko, J., Kantor, S. Early Outcomes with a New Primary TKA System vs. Contemporary TKA: Interim Results of Two Worldwide, Multi-Center Prospective Studies. AAOS, San Diego, California, March 14-18, 2017. Tested implants include: 89% SIGMA, 3% Nex Gen®, 7% Triathlon®, 1% Other.


