**Mako Total Knee application**

The addition of the Mako Total Knee application with Stryker’s market-leading Triathlon Total Knee System expands the current Mako offering to provide a comprehensive solution in the robotic-arm assisted reconstructive service line.

The total knee application was developed based on the Mako Partial Knee application. The three core features: enhanced planning, functional implant positioning, and robotic-arm assisted bone preparation, as well as the procedural workflow were adapted to enable a Mako Total Knee procedure with Triathlon.

**Enhanced planning**

CT data is segmented to create a 3D model of the patient’s bony anatomy. The total knee application allows a surgeon to manipulate the Triathlon implant on the patient’s virtual 3D anatomy taking into account the 6 degrees of freedom, implant alignment in all three planes, and consider key anatomic landmarks such as the transepicondylar axis, posterior condylar axis and the mechanical axis during planning.

**Functional implant positioning**

After assessing the patient’s ligament tension, gap analysis, and limb alignment, surgeon controlled intra-operative adjustments can be made to the pre-operative plan in both flexion and extension before bone preparation.

**Robotic-arm assisted bone preparation**

The Mako Total Knee application does not require cutting blocks, A/P sizing guides, ankle cradles, or intramedullary rods for bone preparation. Similar to Mako Partial Knee, the total knee application creates a stereotactic boundary which assists the surgeon in executing both the tibial and femoral bone resections to plan. The stereotactic boundary has the potential to protect essential anatomical structures of the knee during bone preparation including the PCL and the popliteal artery.
Triathlon Total Knee System
Triathlon and the single radius are designed to work with the patient’s body. Studies have shown that Triathlon and the single radius offer:

- Stability\(^1\,^4\)
- Satisfaction\(^5\)
- Survivorship\(^6\,^9\)

**Stability**
The Triathlon single radius is designed to restore the knee’s single center of rotation during active flexion, where most motion occurs\(^18\,^19\). This allows for constant ligament tension and stability in flexion\(^1\,^4\).

**Normal gait patterns**
In a study from 2015, Triathlon patients exhibited gait that closely mimicked that of healthy control subjects. However, the multi radius knee differed from controls in important knee kinetic and kinematic properties\(^3\).

**PS kinematics**
The Triathlon PS femur is designed to engage the post of the tibial insert at approximately 45°, where natural PCL loading occurs\(^14\).

### Satisfaction
A 2014 investigation of Triathlon patients showed that all patients were satisfied with their implant and surgical results, even when a small amount of residual pain was reported\(^5\).

**Survivorship**
Multiple studies\(^6\,^7\) and joint registries\(^8\,^9\) from around the world consistently show high rates of survivorship with Triathlon.

<table>
<thead>
<tr>
<th>Source</th>
<th>Survivorship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harwin et al.(^6), 2013</td>
<td>99.7% at 7 years</td>
</tr>
<tr>
<td>Scott et al.(^7), 2014</td>
<td>99.5% at 5 years</td>
</tr>
<tr>
<td>2014 National Joint Registry (UK/Wales)(^9)</td>
<td>97.6% at 7 years (including infection)</td>
</tr>
<tr>
<td>2014 Australian Orthopaedic Association Joint Registry(^9)</td>
<td>96.6% at 7 years (including infection)</td>
</tr>
</tbody>
</table>

X3's patented\(^10\) sequential irradiation and heat process, without the use of additives, allows for the following:

**Mechanical strength**
X3 and Triathlon PS showed no mechanical failures at minimum 5 years in a clinical study\(^11\).

**Wear resistance**
X3 demonstrated 30% less wear than the “30 Year Knee” in laboratory testing\(^12\).

**Oxidation resistance**
X3 has demonstrated similar oxidation resistance to virgin polyethylene\(^13\).

#### Flexion degree of post engagement\(^14\,^17\)

<table>
<thead>
<tr>
<th>Normal knee</th>
<th>Triathlon</th>
<th>Attune</th>
<th>Sigma</th>
<th>NexGen</th>
<th>GEN II/ Legion</th>
</tr>
</thead>
<tbody>
<tr>
<td>45°</td>
<td>45°</td>
<td>87°</td>
<td>70°</td>
<td>90°</td>
<td>60-70°</td>
</tr>
</tbody>
</table>
References:

5. Bhowmik-Stoker et al. Mid-Term Results of Patient Satisfaction Following Total Knee Arthroplasty. ICJR (2014).
15. FFC Sigma Technical Monograph. DePuy Orthopaedics. 0611-29-050 (Rev. 1).