Advanced Bearing Acetabular System
Design rationale

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Responsible Innovation
Patient demographics have changed over time and today’s patients have both an increased expectation of post-operative functional outcome and the need for a more durable, long lasting implant solution. All patients expect optimised function of their joints to suit their lifestyles and true intra-operative versatility is an essential requirement of any modern day acetabular cup system.

In addition to durability and a low wear solution, both stability and a high range of motion are essential in optimising function and quality of life for today’s more demanding patient population.

The Trinity™ advanced bearing acetabular system offers surgeons a wide range of high performance bearing solutions within a versatile system, utilising the clinically proven fixation of Biomimetic Cementless Technology.
The advanced solution for acetabular hip replacement
The Trinity™ advanced bearing acetabular system consists of a universal acetabular shell designed for use with a seamless range of high performance bearings.

- BIOLOX® delta ceramic-on-ceramic
- HXLPE highly cross-linked polyethylene
- ECiMa™ (vitamin E) highly cross-linked polyethylene

The Trinity™ two-in-one shell allows all three bearings used in one design that seamlessly integrates the maximum articulation size. The ceramic and metal inserts lock securely onto the taper providing high axial resistance. The 18° taper is designed for optimal security and ease of insertion without misalignment. The polyethylene insert also locks into the castellations which provide high torsional resistance to rotation.
- Trinity™ hemispherical titanium shell is designed for excellent initial press-fit and long-term stability
- Vacuum plasma pure titanium and Biomimetic Cementless Technology for clinically proven long-term fixation\(^2,3\)
- Highly polished Prime™ rim to prevent irritation and impingement of the psoas
- Biomimetic Cementless Technology -coated Hydrolok occluders fill the screw holes minimising fluid pathways
- Screws can be used by removing Hydrolok occluders for versatile fixation
- Thirteen shell sizes for patient matched solutions
The Trinity™ advanced bearing system is designed to allow maximum bone preservation without compromising range of motion or stability. The system includes shell sizes from 44mm to 68mm and provides a full range of bearing sizes from 28mm through to 40mm in all high performance bearing options.

- 28mm bearing in a 44mm and 46mm shell
- 32mm bearing in a 46mm to 50mm shell
- 36mm bearing in a 50mm to 68mm shell
- 40mm bearing in a 54mm to 68mm shell

The BIOLOX® delta ceramic-on-ceramic, HXLPE and ECiMa™ (vitamin E) highly cross-linked polyethylene bearings all follow this size range philosophy, allowing the surgeon to deliver a patient matched solution.
Trinity™ shell outer diameter

Taper size

Ceramic liner

Polyethylene liner (UHMWPE, HXLPE and ECiMa™)

Polyethylene liner (HXLPE and ECiMa™ only)

Note: Trinity™ compatible with BIOLOX® delta and ECiMa only
BIOLOX® delta ceramic

BIOLOX® delta ceramic is an alumina composite which is a low wear ceramic high performance bearing and to date there have been over half a million implanted worldwide. This fourth generation composite contains 82% alumina, 17% zirconia and other trace elements such as strontium oxide. The zirconia and strontium oxide reduce the incidence of micro-crack propagation within the matrix. In addition the oxide mixture forms platelet shaped crystals which prevent crack propagation by deflecting the crack pathway and neutralising crack energy.

The high density and small grain microstructure of BIOLOX® delta allows increased fracture toughness and strength in comparison to previous ceramics. These properties result in a long lasting and highly wear resistant material. The increased fracture toughness of the ceramic enables the bearing to be increased to 40mm, providing a stable total hip with a high range of motion.
ECiMa™ material is a highly cross-linked polyethylene containing vitamin E which has been designed for high performance and long-term durability.

- **E** vitamin E enhanced polyethylene
- **C** cold
- **i** irradiated
- **M** mechanically
- **a** annealed

ECiMa™ material contains vitamin E which provides a protective barrier that prevents both on shelf and in vivo oxidative degradation. Vitamin E is a naturally occurring anti-oxidant and is therefore fully biocompatible. The technology was developed to solve the issue of in vivo oxidation of conventional highly cross-linked polyethylene that has recently been highlighted. The oxidation cascade initiated by absorbed lipids and free radical formation during cyclic loading cause re-melted and sequentially annealed highly cross-linked polyethylenes to degrade. ECiMa™ is protected from this by the oxidative resistance of vitamin E during cyclic loading and lipid diffusion.

Processing the material through steps of cold irradiation (Ci) followed by mechanical annealing (Ma) allows the material to be processed below the melt temperature and therefore maintains crystallinity and mechanical properties, including fracture toughness. As the fracture toughness of ECiMa™ is increased compared to previous conventional highly cross-linked polyethylene, the associated failures seen with earlier generations of cross-linked polyethylene may be avoided. ECiMa™ is consolidated through direct compression moulding which produces a more uniform structure with less voids, improved ductility and improved wear characteristics.
The Biomimetic Cementless Technology-coated Hydrolok occluders are pre-assembled within the shell which gives the surgeon two options within one design.

The Trinity™ shell gives the option for three screws to be used for additional fixation. If only one or two screws are utilised the other screw holes remain occluded, preventing a pathway for fluid between the insert and the acetabular bone.

The Hydrolok occluders are Biomimetic Cementless Technology-coated to increase the surface area for bone on-growth.

The apical occluder is also delivered within the shell packaging so the shell can be sealed prior to introduction of the insert.
Biomimetic Cementless Technology

Biomimetic Cementless Technology is a bioactive calcium phosphate (CaP) coating with a microcrystalline structure which maintains substrate surface roughness, providing a large area for bone integration. The biphasic composition of this coating (>70% brushite) has been shown to promote short and long term osseointegration while the bone like (biomimetic) coating morphology can provide a potent capillary effect which may help to accelerate the implant healing process\(^2,3,12,13,14,15,16,17,18\).

The room temperature electrolytic deposition process results in the formation of a 20µm thin, needle-like, microcrystalline coating (brushite) similar in morphology to natural bone tissue. This allows the Biomimetic Cementless Technology to integrate seamlessly into the bone tissue development process\(^12,14,19,20,21\).

The needle-like CaP platelets, stacked parallel to each other have a hydrophilic effect on blood which may be beneficial for the adsorption of growth factors and adhesion of bone cells\(^13,15\).

Advanced biomimetic cementless coating with more than 20 years of clinical history\(^2,3,15\)
References: