Final setting onto the Stem:
• The stem taper must be dry and free of any blood or debris (i.e., clots, bone or cement particulates).  
• Place the BIOLOX OPTION head assembly onto the stem taper and a twisting motion, while applying manual pressure until small crack lines.  
• A key step is to make sure the head is seated with the assembled adapter onto the stem taper. Do not use the BIOLOX OPTION head system if pressure is necessary to seat the device.
• For heads with diameter 28 and 32mm: Seat the assembly using the plastic impactor on the pole of the femoral head with a twisting motion, while applying manual pressure and a light hammer.
• For heads with diameter 36 and 40mm: Seat the assembly firmly/moderately a minimum of three times to ensure full seating on the stem taper (Fig. 4a).

Flexible assembly of the head facets by trying to remove the head by hand.

For trial reposition, check range of motion and stability using the corresponding instruments and trial heads of the selected femoral head and acetabular cup.

What is BIOLOX delta?
The new alumina matrix composite BIOLOX delta meets the increased demands in hip replacement. This high-performance ceramic offers the same advantages as alumina ceramics, i.e. excellent bio-incompatibility, low wear, high toughness, superb chemical and hydrothermal stability, but with higher strength than alumina ceramics.1

References

BIOLOX®* OPTION Ceramic Femoral Head System
Concepts of head and metal head adaptors, for primary and revision cases.

The BIOLOX®* OPTION Ceramic Head is made from a new alumina matrix composite developed by Ceracera GmbH.
BIOLOX OPTION Ceramic Femoral Head Data Sheet

Science behind BIOLOX Delta Material
BIOLOX forte is an alumina ceramic composite ceramic consisting of approx. 82% alumina (Al₂O₃), 17% zirconia (ZrO₂) and other trace elements (percent by volume). The pink color is due to the trace element zirconium (Zr) that enhances the hardness of the composite material. Alumina provides the material’s hardness and wear resis-
tance, while zirconia, together with other additives, provides improved mechanical properties. The high density of the material and the very small grain size also contribute to the improved properties.

The result is a high performance ceramic that offers the same advantages as BIOLOX forte: excellent bio-compatibility, low wear, high hardness, good mechanical performance, superb chemical and biological stability.

The several toughening mechanisms is achieved by the addition of zirconium oxide, which forms platelets like crystals. These platelets dissipate energy by deflecting cracks, thereby increasing material strength and toughness.

**BIOLOX OPTION Ceramic Femoral Head Data Sheet.**

**Table: Mechanical Properties**

<table>
<thead>
<tr>
<th>Material</th>
<th>Density (g/cm³)</th>
<th>Hardness (Mohs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alumina</td>
<td>3.98</td>
<td>9</td>
</tr>
<tr>
<td>Zirconia (Y-TZP)</td>
<td>4.37</td>
<td>9</td>
</tr>
<tr>
<td>Composite Material</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Mechanical Benefits**

1. Improved hardness.
2. Good surface finish.
3. Stress corrosion cracking-resistant.
4. Wear resistance.
5. Lower coefficient of friction.

**Microstructure**

- The Microstructure: Toughening mechanisms used in BIOLOX delta material result from the introduction of small, homogeneously distributed crystalline platelets in an alumina matrix. These platelets are platelet-like crystal.
- Zirconia (Y-TZP) in a stable alumina matrix. The spatial separation of these platelets results in an optimal distribution of pressure and a taper-like trapezoidal shape of the head.
- The Microstructure: Tightening mechanisms used in BIOLOX delta material result from the introduction of small, homogeneously distributed crystalline platelets in an alumina matrix. These platelets are platelet-like crystal.
- Zirconia (Y-TZP) in a stable alumina matrix. The spatial separation of these platelets results in an optimal distribution of pressure and a taper-like trapezoidal shape of the head.

**Enhanced Variability with BIOLOX delta**

BIOLOX Option delta head system can be used in combination with compatible wrought and ceramic femoral stems for total or revision arthroplasty. A variety of diameters and lengths are available for various patient presentations, adjustment of the version of the component, and reconstruction of the center of the physiological head of the femur. The size of the femoral head selected must match the inner diameter of the acetabular socket. The BIOLOX delta head system may only be used in combination with highly cross-linked or powdered polyethylene (PE). To determine whether these devices have been authenticated for use is a detailed procedure, please contact your Zimmer sales representative or visit Zimmer Web site: www.products.zimmer.com.

**Microstructure of BIOLOX delta (Courtesy of Zimmer)**

**Image:**

- Microstructure of BIOLOX delta.
- Crystal-like structure of the BIOLOX delta material.
- Platelet-like crystal.

**Improved Mechanical Properties**

The excellent flexural strengths and induced grain size of BIOLOX delta material explain its use as an alternative bearing material, when articulating against highly-cross-linked polyethylene.

**Material and Properties of Third Generation Alumina and Alumina Matrix Composite Ceramic**

**Properties**

- Density: 4 g/cm³
- Hardness: 1500 Vickers
- Modulus of elasticity (E): 350 GPa
- Poisson’s ratio (ν): 0.3
- Coefficient of thermal expansion (α): 6.5 × 10⁻⁶/°C
- Thermal conductivity (λ): 22 W/m K
- Water take-up (WtU): 0.1%
- Microhardness (Hv): 1800 ± 200

**BIOLOX delta Ceramic Femoral Head**

The BIOLOX Option head system addresses the needs of the orthopaedic surgical community for a system that can be used in cases of primary and revision surgery in order to offer the patient a low-wear bearing system. Additional rough necks and stem options are available for total hip replacements. The BIOLOX delta head system offers a wide range of combination possibilities.

**BIOLOX Option delta head system consists of two components:**

1. Head adapter
2. BIOLOX delta ceramic femoral head

**The head adapter is made from transalloy alloy Tefakon® (ISO 5832-3), with an 12/14 inner taper that interlocks with the femoral stem. The ceramic femoral head is specifically designed for tapered backstabilized stems. The surface structure of the femoral head and the head adapter taper geometry during tapping with the component, which results in an optimal distribution of pressure and a taper-like trapezoidal shape.

**Example of Legacy Centerpulse Taper Micrographs**

- **Microstructure of BIOLOX delta (Courtesy of Zimmer):**
  - Microstructure of BIOLOX delta.
  - Crystal-like structure of the BIOLOX delta material.
  - Platelet-like crystal.

**Clinical Benefits**

The MICRO structure ensures that there is a minimal significant decrease in impingement, collateral and migrations with stems ceram-on-ceramic coupling (β<10%) when compared to zirconium femoral heads (β>15%) for:

- **Enhanced Wear Resistance**
- **Increased Clinical Performance**
- **Reduced Failure Rate**

**Fig. 2:**

- **Image:**
  - Microstructure of BIOLOX delta.
  - Crystal-like structure of the BIOLOX delta material.
  - Platelet-like crystal.

**Surgical Technique Considerations BIOLOX Option Head System**

The BIOLOX Option head system is used in combination with zirconium stems, and in combination with highly cross-linked or powdered polyethylene.

**Preoperative Planning**

- **Planning of the operation is based on the information available, the identification of the case, which consists in size, and the condition of the stem taper:**
  - Of prime importance during the preoperative planning.
  - The taper of the head adapter must fit the stem taper.

**Technical information concerning compatibility and stem taper:**

- **Surgeon can be found on our face page:**

**Surgeon can be found on our face page: www.products.zimmer.com.**

**Benefits**

- **Possibility for low-wear ceramic solution in revision and primary cases.**
- **Enhanced head system can be assembled with pristine or used stem tapers.**
- **Stem taper does not require the reduction of motion.**
- **Improved mechanical properties compared to alumina heads.**
- **Easy assembly of head and adapter.**
- **Same benefits for BIOLOX forte material compared to BIOLOX delta.**

**Sizing**

- **Head diameter:** 28, 32, 36 and 40 mm
- **Neck length:** 50, 60, 70, 80 and 120 mm
- **12/14 stem taper adapter.**

**Fig. 6:**

- **Image:**
  - Microstructure of BIOLOX delta.
  - Crystal-like structure of the BIOLOX delta material.
  - Platelet-like crystal.

**Useful Tips**

- **Determine the neck length.**
- **Check stem balance.**
- **Check range of motion.**

**Assembly of Ceramic Femoral Head and Adapter:**

- **Ensure selection of the correct BIOLOX OPTION head system fixture:**
  - (diameter, taper size, rock, length, material, integration, etc.)

- **BIOLOX forte, BIOLOX delta head and adapter must be implanted together:**
  - Before the final packaging of the BIOLOX OPTIONS ceramic femoral head, the operating surgeon must assemble the BIOLOX OPTION head system in the package shell according to the diagram shown below.

- **Please note, the BIOLOX forte head and adapter are packaged together:**

  **Image:**
  - Microstructure of BIOLOX delta.
  - Crystal-like structure of the BIOLOX delta material.
  - Platelet-like crystal.

**Fig. 7:**

- **Image:**
  - Microstructure of BIOLOX delta.
  - Crystal-like structure of the BIOLOX delta material.
  - Platelet-like crystal.

**Assembly of the BIOLOX OPTION Head System:**

- **The composite femoral head is placed on the head adapter, which remains in its position, and pressure is applied until resistance is felt:**
  - The ceramic femoral head is instantaneously straight down into the sleeve.

- The system components are ready for assembly on the femoral stem, no sawing or cleaning is necessary.