

## 5.4 Experience with BIOLOX® option revision heads

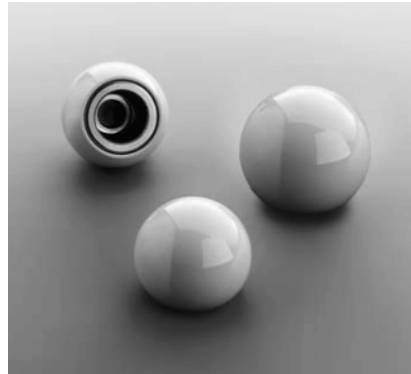
T. Güttler

### Introduction

The combination of modular ceramic heads with adapters or sleeves between hip taper and ceramic head offers new possibilities for the use of ceramic implants in primary and revision hip replacement. Several concepts for modular heads with sleeves to be used on tapered cones of hip stems were published and patented in the 1980's, but not introduced for ceramic implants in hip replacement.

A versatile modular sleeve / head system for total hip arthroplasty was designed by Anapliotis and Kranz, Merete Medical Berlin in the mid 1990's. Different options for neck length and offset were available for several approved taper specifications. This modular head system was initially introduced with the trademark Multiset and later Bioball. The modular Bioball heads were offered in CoCr metal alloy and  $ZrO_2$  ceramic. In 2005 the modular ceramic Bioball heads became also available in Biolox® delta material.

Based on the experiences of the modular Bioball system and the availability of Biolox® delta  $Al_2O_3$  Matrix Composite Ceramics, Ceramtec developed the Biolox option head range for standard and XL modular neck lengths [1,2]. The basic features and THA applications of the Biolox option heads offer a modular ceramic head solution for hip revision, new possibilities of a wear couple upgrade at time of revision and additional options for primary THA.



**Figure 1:**  
Biolox option revision head implants  
28 mm, 32 mm and 36 mm.

Biolox option implants are offered by different orthopaedic companies which approve the use with specific femoral stem implants and taper specifications.

#### *Important note:*

The instructions for use of Biolox option implants must always be followed. They define the use of Biolox option implants in combination with approved hip implant components.

In 2006 Biolox option implants are available for 28 mm, 32 mm and 36 mm Biolox delta heads. The taper specifications will be further extended and approved for specific hip stems. Biolox option heads can be combined with approved Biolox forte and Biolox delta acetabular cup implants and approved polyethylene implants.

## Intraoperative application of Biolox option implants

The adapter sleeves of Biolox option head are made of forged titanium alloy Ti6Al4V which increase the strength of the ceramic head for taper conditions encountered during revision surgery. The Biolox option adapter sleeve levels out irregularities on the cone from damage after a head replacement. The head to be replaced must be removed using an extractor or a pestle in such a way that the cone suffers the least possible damage.

Prior to a decision for using a modular Biolox option head, the condition and compatibility of the cone of the implanted hip stem needs to be assessed. Three different cases can be identified concerning the cone conditions:

- Case 1 – a new unused cone
- Case 2 – a used cone after replacement of a prosthetic head
- Case 3 – a damaged cone

Case 1 occurs in primary application, e.g. when implanting a ceramic head of neck length XL in primary THA. Case 2 applies to the standard application for the modular Biolox option prosthetic hip heads in case of hip revision. The case 3 cone condition applies to the special application for the modular Biolox option prosthetic hip heads, where the cone damage can be of the following degrees:

- Degree 1 – No visible damage, cone shape intact
- Degree 2 – damage with visible scratches up to 0.3 mm, but no change of the cone shape (Fig. 2)
- Degree 3 – ablation of cone surfaces (beveled, leveled, crushed) or visible abrasion on the cone (Fig. 3)

Cone damages of degrees 1 and 2 are leveled out by the adapter sleeve of the Biolox option prosthetic hip heads. Any cone damage of degree 3 precludes the application of Biolox option implants.



**Figure 2:**  
Example for a grade 2 damaged taper.



**Figure 3:**  
Example for a grade 3 damaged taper.

The intraoperative assessment of the cone condition especially in cases of cone damage might be difficult in some cases. An additional tip for the surgeon might be how smooth the head fits on the cone during final insertion of the Biolox option head. After coupling of the sleeve with the ceramic head, the Biolox option implant must be coupled to the taper in the same way as any other modular head. This coupling should be possible in a smooth and easy way, and when turning the Biolox option implant on the taper the contact or taper-fit should not change due to the existing taper damage. If there is any doubt that the taper and coupling condition is compromised, the application of Biolox option implant is not approved.

## Use of Biolox option Implants in primary hip replacement

In cases of primary hip replacement Biolox option implants generally supplement the use of Biolox ceramic implants. Beside the obvious advantage of an additional XL neck length limitations of ceramic implant handling leading to poor taper conditions are facilitated in case of an intended use of a ceramic THA solution for the patient:

- ceramic XL head
- secondary taper coupling
- unexpected taper damage
- ceramic head stock back-up

### Ceramic XL head

Biolox ceramic heads are generally available in short S, medium M and long L neck lengths. Biolox option heads offer an additional XL neck length for ceramic on polyethylene or ceramic-on-ceramic THA indications. Since the Biolox option XL head design is not skirted, the free range of motion is similar to the L head design. With the distribution of S, M, L and XL heads being roughly 20%, 45%, 20%, and 15% respectively, the XL-Biolox option head can replace a significant number of XL metal heads and gain the benefit of improved wear characteristics against polyethylene, of extended range of motion compared to skirted metal XL heads, and of course in ceramic-on-ceramic articulations.



**Figure 4:**  
BioloX option head with XL length in primary THA.

### **Secondary taper coupling or unexpected taper damage**

BioloX option heads can be used in primary THA in any case where the taper is used or even damaged during primary hip intervention, and a ceramic head is indicated. It must be mentioned, that an unplanned intraoperative removal of a BioloX ceramic head prevents the use of a new ceramic head implant. In this case a BioloX option head is the safe ceramic solution.

### **Ceramic head stock back-up**

In very rare cases where BioloX head implants become unsterile during surgical intervention or when a package is opened, a BioloX option head stock offers always an alternative ceramic implant selection. The aspect of an incomplete ceramic head implant stock should be also mentioned here.

### **Use of BioloX option implants in revision hip surgery**

The primary use of BioloX option implants is the use in revision hip surgery. The BioloX option implants are primarily suitable in cases of acetabular cup or liner exchange when ceramic implants have been used, or in order to improve the wear characteristics. Other less common applications include cases of ceramic implant failures or with complications associated with immunological response to metal implant components. Different revision surgery situations are discussed as follows:

- modular head exchange
- acetabular liner revision
- acetabular cup revision
- failure of ceramic implant components
- allergy to metal implant components

### **Modular head exchange**

As mentioned above the use of Biolox ceramic heads is only approved for use on an unused hip taper. Any exchange of any modular head to a ceramic head requires the use of an approved Biolox option head. The reasons for modular head exchanges can vary and a modular head exchange during hip revision happens more often than in primary cases. In these cases the use of a head removal instrument is recommended.

The exchange of a modular head without exchange of the acetabular cup component may be indicated in cases of recurrent dislocation. Biolox option offers a solution for the used taper after ceramic head removal, including the XL-neck length. Also, it is possible to convert the head diameter from 28 to 32 mm, or to 36 mm with appropriate cup sizes.

A special requirement for head exchange might occur in the case of a ceramic insert discovered in situ unexpectedly during surgery. This can happen because x-rays are not always sufficient to identify the material of the modular cup insert. Even in case of a proper preoperative planning the intention to exchange the modular ceramic head to a metal head might be not possible, and a Biolox option head offers a solution.

### **Acetabular liner revision**

The exchange of an acetabular liner is generally possible without changing the modular head. In cases of dislocation, the intention of liner exchange will be to use a more constrained polyethylene liner. In cases of acetabular wear, the intention might be to upgrade the hip articulation to a ceramic-on-polyethylene or even ceramic-on-ceramic total hip replacement if the cup component allows for a ceramic liner. These options are possible with Biolox option implants. Also, a ceramic head with increased diameter and neck length can be implanted together with an acetabular liner exchange. In any case, the liner revision is facilitated with the removal of the modular head. In this case, the use of trial heads and trial cups are well suitable to verify the additional joint stability before using inserting the optimal liner and head combination.

### **Acetabular cup revision**

The complete revision and implantation of an entire acetabular cup implant is nearly impossible without removal of the modular head. In that case, the implantation of a new ceramic Biolox head is only possible with Biolox option implants on approved stem tapers. In cases of a metal head articulation at the time of revision, this procedure could also result in wear couple upgrade. With appropriate revision cup systems a ceramic-on-ceramic THA articulation is also a possible option, if implant alignment, joint stability or any other factors do not contraindicate such a THA treatment. Note that ceramic implant liners are not available as constrained, posterior wall, asymmetric, or offset liners, etc., which are more common in hip revision surgery.

### **Failure of ceramic implant components**

In cases of ceramic component failure the use of a metal head against polyethylene can lead to secondary complications due to worn out metal heads after ceramic implant component failure [3,4,5].

Biolox option heads offer the possibility to exchange the original ceramic head to a new ceramic head without stem revision if the taper damage conditions are still appropriate. The recommendation for the cup is either a ceramic insert (if possible) or a polyethylene insert. A ceramic liner must be always exchanged in cases of a fractured ceramic head.

### **Allergy to metal implant components**

Since ceramic materials offer an alternative material option, the situation of an unidentified or even verified need to exchange metal hip articulation components due to immunological response to Co, Cr, Ni etc. alloy components should be mentioned. In cases where titanium implants are used, a metal head on polyethylene or a metal on metal hip articulation – with a modular cup component - could be converted to a Biolox option head either against polyethylene or ceramic cup liners. These cases are rare but the surgeon should consider the extended possibilities of Biolox option implants.

## **Conclusion**

Biolox option heads present a valuable additional ceramic implant solution, which will be available with more approved stem implants for Biolox ceramics. Composite solutions of metal sleeves and ceramic heads offers new applications in standard THA and revision hip replacement.

## **References**

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