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Case Report

# Removal of a well fixed cemented acetabular component using biomechanical principles

A. Gordon Burgess*, Colin R. Howie

*Royal Infirmary of Edinburgh, 51 Little France Crescent, Edinburgh EH16 4SA, United Kingdom*

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ABSTRACT

*Background:* Removal of well fixed components can be a complex problem facing an orthopaedic surgeon during revision hip arthroplasty. As the burden of revision hip surgery increases, techniques have been described to enable safe and reliable removal of well fixed components. Removal of well fixed cemented components requires different considerations to the removal of cemented components. Polymethylmethacrylate bone cement and polyethylene have unique biomechanical properties.
*Method:* We present a step-by-step technique to reliably and safely remove a well fixed cemented acetabular component and underlying cement during revision hip arthroplasty.
*Results:* This reproducible technique is presented with intra-operative photography and a detailed description of the necessary steps to remove a well fixed cemented acetabular component.
*Conclusion:* Consideration of important underlying biomechanical principles of polymethylmethacrylate bone cement and polyethylene can aid the safe removal of a well fixed cemented acetabular component in revision hip surgery, reducing risk to underlying bone.


## 1. Introduction

The success of total hip arthroplasty, along with increasing healthy life expectancy, is likely to contribute to an increased burden of revision hip arthroplasty for wear. The main indications for revision hip arthroplasty today are aseptic loosening, dislocation, infection and pain.[1,2]

Removal of old well fixed components is one of many complex aspects of revision arthroplasty facing the orthopaedic surgeon. Techniques for removal of well fixed femoral components, both cemented and un-cemented, are well described, however there remains little literature regarding the removal of a well fixed cemented acetabular component. Previous techniques offer different approaches this problem including the use of pneumatic devices, burrs and a variety of reamers, drills and corkscrews.[3–7]

Polymethylmethacrylate bone cement has high load to failure in compression, however in tension this is reduced significantly. This technique allows the controlled separation of the implant–cement interface under tension to effectively loosening the acetabular component. Polyethylene has a high modulus of elasticity and hence elastic recoil. Whilst polyethylene is easy to mark and cut, the elastic recoil easily traps the cutting device before it can pass all the way through. The surrounding bone is often relatively weaker than the construct itself.

We describe a method for sectioning of the polyethylene cup and controlled disruption of the implant–cement interface to allow safe and reliable removal of the well fixed cemented acetabular component.

## 2. Case

A 78-year-old male presented with recurrent dislocation of cemented primary total hip replacement. The original procedure, for arthritis secondary to haemochromatosis, was complicated by recurrent dislocation. Revision surgery was indicated for recurrent dislocation due to loss of soft tissue integrity. The acetabular component was well fixed. The femoral component was removed to aid acetabular exposure. Informed consent was provided by this patient for use of intra-operative photography for inclusion in this article.

### 2.1. Surgical technique

A standard approach the hip is made at the discretion of operating surgeon. In this case a posterior approach was made.

* Corresponding author.
*E-mail addresses:* agburgess@hotmail.com (A. G. Burgess), colin.howie@ed.ac.uk (C.R. Howie).

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Once the hip is dislocated the femoral component is either removed, or retracted to facilitate exposure of the acetabular component. Removal of fibrous tissue and so-called "pseudocapsule" in a methodical manner to adequate expose the full rim of the polyethylene acetabular component is required.

Once the acetabular component is adequately exposed, a central 6 mm drill hole is created down to the underlying cement (Fig. 1). The audible and tactile change in drilling between the polyethylene and cement will alert the surgeon once the implant is perforated. Subsequently, a 6 mm drill is then used to sequentially perforate a mapped quartile of the hemisphere down to the underlying cement and an oblique drill hole is created joining the previous drill holes within the substance of the cup (Figs. 2 and 3). The drill holes are then joined up using a thin acetabular cup cutting tip osteotome (Stryker(c)), thus completely sectioning one quarter of the hemispheric component from the other three quarters (Figs. 4 and 5). Occasionally the osteotome does not fully cut medially but this will become obvious with the next step and can be addressed again. In this case a central 10 mm drill hole was made, as pictured, however we now do not perform this step routinely.

Once the polyethylene is sectioned, a 5 mm straight revision osteotome is then driven into the rim of the separated quarter across the rest of the cup. Using the osteotome as a lever, this segment removed from the underlying cement by levering inward (Figs. 6 and 7). The osteotome is removed from the explanted quarter (using a hammer as the elastic recoil traps the osteotome) and re-inserted into the remaining three quarters (Figs. 8 and 9). With a simple circular twist, once again levering towards the cup centre, the remaining three quarters of the polyethylene is removed (Fig. 10).

The underlying cement mantle is typically preserved by this technique and can be left in or removed at the discretion of the surgeon and demands of the surgical procedure (Fig. 11).

In this case we removed the cement mantle after removal of the acetabular component. The technique for removing the underlying cement mantle involves splitting the brittle cement with a straight narrow disposable osteotome in a random pattern, working from the margin of the mantle itself by creating local stress risers leading to fracture (the osteotome is not inserted deep into the cement). The cement fractures and comes away easily from the underlying bone. It is important to work steadily across the cement mantle and perpendicular to the surface, breaking it up gradually

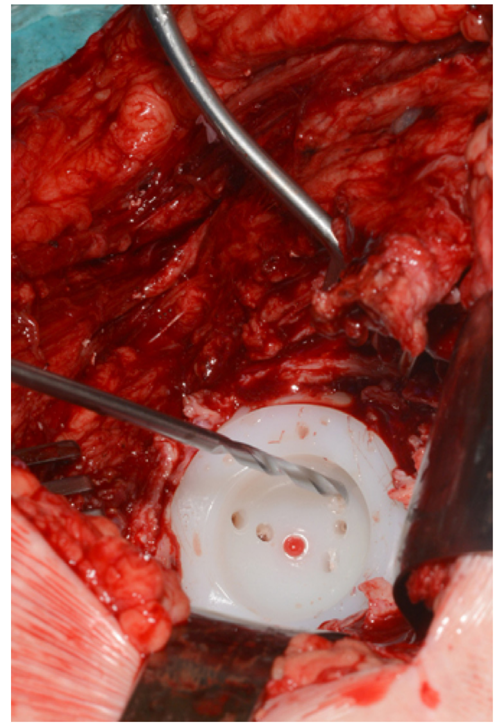

**Fig. 2.** Further 6 mm drill holes are made along one quarter of the polyethylene.

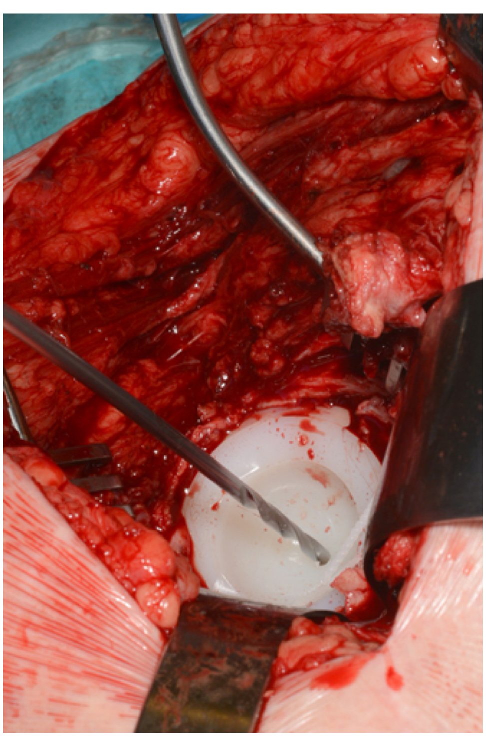

**Fig. 1.** A central 6 mm drill hole is made through the polyethylene component to the underlying cement.

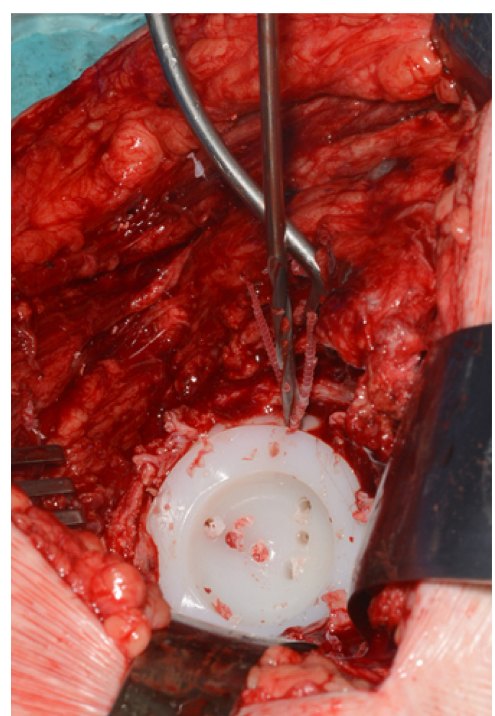

**Fig. 3.** An oblique drill hole is then made connecting the series of drill holes made to the centre component.