Fixation Strength of a Dual-Mobility Acetabular Component Cemented Into a Well-Fixed Metal-Back During Revision THA

[1, 2] Wegrzyn J, [1] Thoreson AR, [1, 2] Guyen O, [3] Lewallen DG, [1] An KN

[1] Biomechanics Laboratory, Mayo Clinic, Rochester, MN
[2] Department of Orthopedic Surgery – Pavillon T, Hôpital Edouard Herriot, Lyon, France
[3] Department of Orthopedic Surgery, Mayo Clinic, Rochester, MN

This study was supported by the Mayo Foundation (Rochester, MN USA).
Implants were provided by Amplitude (Valence, France).

MAYO CLINIC

Conclusions

A dual-mobility acetabular component cemented into a well-fixed metal-back constitutes a reliable and biomechanically safe alternative to acetabular shell removal or to cementation of polyethylene liners while simultaneously preventing instability of the THA revision.

Introduction

Cementation of polyethylene (PE) liners into well-fixed metal-backs has become a popular option during revision total hip arthroplasty (THA) particularly for older and frail patients. This technique provides a straightforward alternative to removal of a well-fixed metal-back due to a failed locking mechanism, the unavailability of matching liners or the need to slightly re-orientate the acetabular component.

Although dramatic results were reported with the use of dual-mobility acetabular components to manage hip instability during revision THA, no study to date evaluated the fixation strength of the cementation of a stainless steel dual-mobility acetabular component into a well-fixed metal-back **(Fig. 1)** [1, 2].

Purpose

This study has been designed to assess lever-out and torsional strength of the cemented fixation of a dual-mobility shell into a well-fixed metal-back in order to validate the use of this technique in routine surgical practice.

Hypothesis

Cementing a dual-mobility component is a relevant option providing fixation strength as high as that of cementation of a standard all-PE component.

Fig. 1: Dual-mobility component (Saturne®, Amplitude, France)

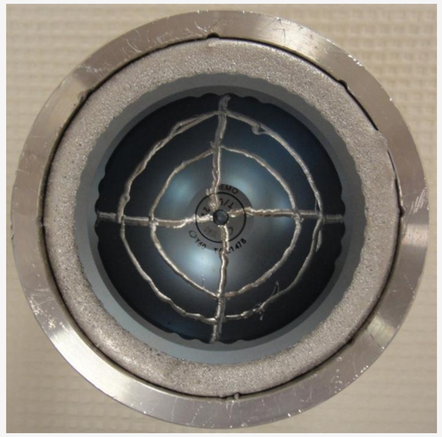

Fig. 2: Simulated well-fixed metal-back with cruciform and concentric grooves burred into the inner surface.

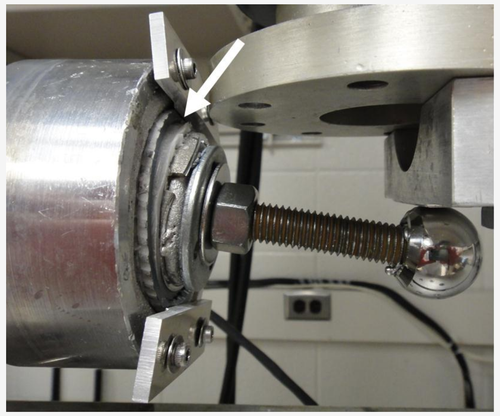

Fig. 3: Metal-back/cement interface failure during a lever-out test (white arrow).

Methods

- Eight stainless steel dual-mobility and eight all-PE acetabular components were cemented into a titanium metal-back with a uniform 2- to 3-mm cement mantle [3, 4].
- A high-speed rotary carbide burr was used to cut a cruciform and 2 concentric grooves into the metal-back inner surface **(Fig. 2)**. This technique has been described intra-operatively to increase cement interdigitation and fixation strength, particularly when the metal-back has a smooth inner surface without holes **(Fig. 2)** [3, 4].
- The strength of the cemented fixation was evaluated using lever-out and torsion testing. The interface at which failure occurred was determined.

Results

- Lever-out testing showed that the cemented dual-mobility cups failed at significantly higher maximum moment than the cemented all-PE cups (104 ± 8 N.m vs. 66 ± 9 N.m; $p<0.0001$).
- During torsion testing, the maximum moment of the cemented dual-mobility cups was 128 ± 24 N.m. However, no direct comparison could be performed with cemented all-PE cups due to an early failure of the PE itself before failure of the cement fixation occurred.
- Failure was always observed at the metal-back/cement interface whenever it did occur **(Fig. 3)**.

FDA status

The implants tested in this study are not FDA-approved.

References

1. Guyen O et al., CORR 2009, 2. Guyen O et al., CORR 2007, 3. Haft GH et al., JBJS Am 2003, 4. Kummer FJ et al., J Arthroplasty 2002.

Julien Wegrzyn, MD, PhD
Biomechanics Laboratory
Mayo Clinic, Rochester
julien.wegrzyn@chu-lyon.fr

http://mayoresearch.mayo.edu/mayo/research/biomechanics
Phone: (507) 538-1717
Fax: (507) 284-5392
200 1st St. SW, Rochester, MN 55905