Seating of Ceramic Liners in the Uncemented Trident[®] Acetabular Shell

Is There Really a Problem?

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Received: 1 September 2008 / Accepted: 24 June 2009 / Published online: 7 July 2009
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Abstract Concerns have been raised regarding the risk of incomplete seating of metal-backed ceramic liners in the Trident[®] acetabular system. This prompted us to audit our series of primary and revision THAs. We retrospectively reviewed 68 patients (78 arthroplasties, 55 of which were primary and 23 revisions) using the Trident[®] acetabular system between 2003 and 2007. Anteroposterior and lateral radiographs were reviewed independently by two specialist registrars and one consultant surgeon to look for incomplete seating. Six liners were seated incompletely, representing 8% overall. All unseated liners were in the primary group, representing 10% risk in this group, compared with 0% risk in the revision group. The incidence of malseating in our primary arthroplasty group was similar to the published incidence (16.4%). We encountered no problems in patients having a revision. We suspect shell deformation contributes to malseating of the metal-backed

ceramic liners. To reduce the rate of malseating, we now underream by 0.8 mm rather than the usual 1.8 mm, particularly if the bone is sclerotic.

Level of Evidence: Level IV, case series. See the Guidelines for Authors for a complete description of levels of evidence.

Introduction

Uncemented and hybrid THA techniques have been increasing in popularity in recent years. Uncemented acetabular cups are considered useful, as they promote good osteointegration while also allowing a greater degree of modularity, particularly when choosing bearing surfaces. The modularity allows surgeons to choose the harder metal-on-metal and ceramic-on-ceramic bearing couples in addition to polyethylene. Research in vitro and in vivo suggests substantially reduced wear rates for both bearing types [1, 2].

The Trident[®] acetabular component (Stryker Orthopaedics, Mahwah, NJ) is a commonly used uncemented acetabular component. It may be coupled with a polyethylene liner or a titanium-backed ceramic press-fit liner. Once the acetabulum is implanted and the shell free of debris, the liner is inserted. The Morse taper is engaged with an impactor after the shell and liner are appropriately aligned. This should ensure correct seating (Fig. 1). However, Langdown et al. [3] recently raised concerns regarding incomplete seating of the ceramic liner with this system, suggesting an incidence of malseating of 16.4% in their series of 117 primary hips.

The observation of Langdown et al prompted us to audit our series of Trident[®] acetabular components of primary and revision procedures to support or refute their findings,

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Each author certifies that his or her institution has approved or waived approval for the reporting of these cases and that all investigations were conducted in conformity with ethical principles of research. This work was performed at Robert Jones and Agnes Hunt Hospital.

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Fig. 1A–B (A) AP and (B) a crosstable-lateral radiographs show a well-seated ceramic liner, ie, the liner and shell are parallel.

in particular: (1) our radiographic incidence of malseating (Fig. 2); (2) whether malseating was surgeon specific; and (3) whether there is evidence of clinical problems associated with malseating.

Materials and Methods

We retrospectively reviewed the medical records and radiographs of 68 patients (78 THAs; 55 primary and 23 revision procedures) who had the Trident® uncemented acetabular shell with metal-backed ceramic liner implanted between November 2003 and June 2007 in two National Health Service hospitals. Electronic Patient Record searches allowed all the Trident® THAs to be identified. Our group of patients who underwent primary THA had age and gender distributions similar to those of Langdown et al. [3], with an average age at the time of surgery of 54.69 years and the majority of patients being female (60%). The average age of the revision group was 64.52 years. In accordance with the trust policy, all patients were offered clinical followup at 6 weeks or 3 months and then radiographic and clinical followups at 1 year, 5 years, and 10 years. They also have access to an arthroplasty hotline that allows them to contact a specialist nurse

Fig. 2A–B (A) Lateral and (B) AP radiographs show an incompletely seated ceramic liner in the Trident® shell.

practitioner should they experience any problems, from which further followup can be arranged if necessary. Fifty two of the 68 patients (59 hips) had a 1-year review with radiographic followup, with three patients (three hips) being lost to followup; the remaining 13 patients (16 hips) have yet to reach the 1-year followup.

Six consultants performed the surgeries, with the senior author (NMG) performing the majority (58 of 78). Numerous femoral components were used, including the cemented Exeter™ prosthesis (Stryker) and the uncemented Taper-Lock™ (Biomet Inc, Warsaw, IN) and Restoration™ (Stryker) femoral stems.

We performed a review of the medical records of all 68 patients to identify any adverse events, including revision surgery.

Fig. 3A–C The radiographs show the areas to check for incompletely seated liners. The parallel lines encase subtle malseating that is not always immediately obvious. The white arrows indicate areas of malseating. (A) Lateral and (B) AP radiographs show subtle malseating, whereas more obvious malseating can be seen on (C) this AP radiograph.

We reviewed supine anteroposterior (AP) and cross-table-lateral view radiographs taken routinely within 3 days of the procedure. Two specialist registrars (DWJH, AQ) and one consultant orthopaedic surgeon (NMG) independently reviewed these radiographs using a technique described in the literature [3]. This technique focuses on any gap between the liner and shell on either the AP or lateral views associated with an angulation between the shell and the liner, as these should be parallel (Fig. 3).

Results

Six liners (8%) were considered incompletely seated (three males, three females) (Fig. 2). All six incompletely seated liners were in patients undergoing primary surgery, thus

resulting in an incidence of 10% in the primary group and 0% in the revision group (Table 1).

Four of the consultant surgeons had performed three or fewer of these procedures, with two of these having one incomplete seated liner. Another surgeon had performed nine procedures, with two not being correctly seated. Finally, the surgeon most familiar with this equipment also had only two incorrectly seated liners in a total of 58 procedures. Both occurred in the first 10 procedures. No additional malseating occurred in the following 48 procedures.

There were no recorded adverse events in these patients and none was known to have had a revision procedure. Of the six patients with malseating of the liner, five have a 1-year radiographic followup, and in two of these patients, the liner is now correctly seated.

Table 1. Total number of arthroplasties performed by each surgeon

Surgeon	Total number of procedures	Total number of primaries	Total number of revisions	Total number of unseated liners	Incidence of nonseating
1	58	38	20	2	3.45%
2	2	1	1	0	0%
3	3	3	0	1	33.3%
4	3	2	1	0	0%
5	9	8	1	2	22.2%
6	3	3	0	1	33.3%
Total	78	55	23	6	7.69%

Discussion

We determined whether our series supported published findings regarding the incidence of malseating of the Trident® ceramic liner and considered possible reasons for malseating. We also looked at short-term followup data to evaluate whether malseating is of any clinical importance.

Although there are limitations to our study, particularly the relatively small numbers and the short followup, we believe our findings are still relevant. In particular, we considered the problem of malseating in revision cases, looked at the possible role of surgeon unfamiliarity with equipment, and also used the fact that the center in which this work was done is a specialist center with good links to local hospitals. If patients have problems with their implants, they usually are referred to the initial surgeon or contact the initial surgeon directly through the arthroplasty hotline, and therefore we believe the incomplete followup is not a major limitation.

Radiographic signs of incomplete seating can be subtle, although we found a similar incidence of malseating using the recommended technique. We found the lateral radiograph the most useful and advocate this view be performed routinely as part of the first postoperative radiographic series. Of the six liners that were not seated, all were seen on the crosstable-lateral view radiographs, but only four of these were seen on the AP radiographs.

We share the concerns of Langdown et al. [3] regarding deformation of the shell on impaction, especially in the case of younger patients with better bone stock. Our data suggest an overall incidence of 8% malseating of the metal-backed ceramic liners in the Trident® acetabular system (primary and revision cases) compared with 16.4% reported by Langdown et al. [3]. To date, no patients have reported adverse events at followup or via the arthroplasty hotline and no revision surgery has been performed at our center. Malseating was seen only in the primary THA group. Many possible reasons exist for incomplete seating of uncemented acetabular systems, particularly when using hard bearings. We must consider that initial stability of such systems relies

on accurate reaming and the press-fit design of the shells. It is possible, by underreaming the acetabulum or oversizing the shell, deformation of the metal shell may occur during insertion, particularly if the bone is sclerotic. If deformation occurs, coupling of the shell and liner, by way of the Morse taper, can be affected. As much as 90% of other press-fit cups have measurable compression deformity [4]. This is likely to be more of a problem in the stiffer hard-bearing liners than the traditional polyethylene ones. This also may explain the absence of incomplete seating in the revision group, as these patients tend to be older with reduced bone density and there also may be a reduction in bone stock reducing shell deformation.

Another possible explanation for incomplete seating of the liner is the learning curve encountered with such procedures. No surgeon had more than two malseated liners, although only one surgeon had performed more than 10 procedures and all his malseatings occurred in the first 10 procedures. Surgeons with only one malseated liner performed fewer than five procedures in total.

Revision surgery tends to require greater exposure than primary surgery; thus, assisting observation of the acetabular shell and therefore confirming adequate seating of the liner may be made easier. Our technique continues to evolve. Meticulous approach allowing full 360° observation of the acetabulum is particularly desirable. If the bone is considered sclerotic or hard by the surgeon, we underream by only 0.8 mm rather than the usual 1.8 mm (this is relative overreaming of 1 mm), reducing the risk of deformation of the acetabular shell. Before seating the liner, all soft tissue must be removed and the liner placed accurately. After impaction, we suggest attempting to gently lift the liner out with a Macdonald instrument (blunt double-ended dissector) to confirm adequate seating. Despite this relative overreaming, initial stability was not affected.

With nonclinician followup increasing and the length of hospital followup decreasing, it is important to identify any potential problems early. Although none of the patients with unseated liners have returned to the hospital with problems, our concern would be for early wear attributable

to point loading, ceramic fracture, and the potential for metal ion release owing to movement between the shell and the titanium liner. We will keep our patients under review. Continued careful review of postoperative radiographs in primary and revision THAs is essential.

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