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Case report

Canted seating of the Stryker Modular Dual Mobility liner within a Trident hemispherical acetabular shell

Scott M. Eskildsen, MD, Erik C. Olsson, MD, Daniel J. Del Gaizo, MD *

University of North Carolina, Department of Orthopaedic Surgery, Chapel Hill, NC, USA

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ABSTRACT

A 75-year-old woman who suffered a left femoral neck fracture underwent a left total hip arthroplasty using a Stryker Trident (Kalamazoo, MI) hemispherical acetabular shell and Modular Dual Mobility (MDM) metal liner. Post-operative radiographs demonstrated canted seating of the liner. The patient was taken immediately back to the operating room where the acetabular liner appeared well seated superiorly but was in a canted position inferiorly. Removal and replacement was performed and post-operative radiographs demonstrated complete seating. Subsequent follow up at 6 months demonstrated good clinical function with no adverse radiographic findings. Canted seating is a potential complication of the MDM metal liner. Providers should be aware of potential incomplete seating inferiorly despite the superior portion of the liner being well seated.
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Introduction

Issues with incomplete seating of ceramic acetabular shell liners with the Stryker Trident (Kalamazoo, MI) acetabular system have been described in multiple case reports and retrospective reviews [1–7]. Previous authors have hypothesized that there may be technical aspects that complicate the impaction of the liner or that the Trident shell may deform with impaction, preventing complete seating [4]. We present a similar complication with the Stryker Modular Dual Mobility (MDM) metal liner that has not been reported previously in the literature. This case discusses an instance of incomplete seating of an MDM liner in a Trident acetabular shell that required reoperation.

Case history

The patient was informed and agreed to the publication of material associated with this case. A 75-year-old female sustained a mechanical fall while walking up her driveway. She presented to the Emergency Department at our institution where radiographs demonstrated a displaced left femoral neck fracture (Fig. 1). Prior to this fall, she was ambulatory without the use of an assistive device. She lived self-sufficiently only with her husband and was relatively healthy. Given the patient's activity level and displacement of the fracture, total hip arthroplasty was warranted.

A standard posterior approach was utilized. The femoral head was removed and the acetabulum sequentially reamed using hemispherical reamers to a size 44 based on preoperative templating. A 46 mm shell was impacted allowing for 2 mm press fit followed by placement of two 6.5 mm cancellous screws in the posterosuperior quadrant. The appropriately sized Stryker MDM metal liner was inserted and impacted. It was noted to appear well seated without interposed soft tissue. The femur was then prepared for an Accolade TMZF stem (Stryker Corp., Kalamazoo, MI) which was implanted in standard fashion. The hip was reduced and trialled for a final time with no instability or impingement noted. The wound was irrigated and closed in standard fashion.

It is our practice to obtain immediate post-op films. Upon review of these films it was noted that the inferior portion of the liner was not completely seated (Fig. 2). Given that the patient's spinal epidural was still in place, we discussed the need to return to the operating room to address the liner. We opened our initial incision and noted upon close inspection that, while the superior liner appeared well seated, the inferior portion was incompletely seated in a canted position. We removed the liner and found no

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* Corresponding author. 130 Mason Farm Rd #3155, Chapel Hill, NC 27599, USA. Tel.: +1 919 966 9166.
E-mail address: daniel_delgaizo@med.unc.edu

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Figure 1. Radiograph of a 75 year-old woman with a displaced femoral neck fracture.

gross abnormalities of the acetabular shell or liner. The liner was again impacted into a clean shell with no interposed tissue and seated appropriately both superior and inferior. Intra-operative radiographs confirmed that this was the case. The patient's post-operative rehabilitation went according to plan and she was discharged from the hospital on post-operative day two. At 6 months follow up the patient is doing well clinically, without pain, and ambulating without the use of an assistive device. Radiographs continue to show symmetric seating of the liner without signs of migration (Fig. 3).

Discussion

In this case, the Stryker MDM articulation was used with the Trident acetabular cup to increase stability in the setting of a femoral neck fracture [8]. The MDM articulation has a good track record regarding dislocation with one study demonstrating only two early dislocations related to “technical errors” and only three dislocations after ten years in a series of 668 cases [9]. The Stryker MDM articulation utilizes a thin polished chrome-cobalt acetabular liner that engages the acetabular shell via a taper and articulates with a large diameter highly crosslinked polyethylene head that encapsulates chrome cobalt or ceramic femoral head [10].

The Stryker Trident acetabular shell is a widely implanted uncemented acetabular component that can be used with multiple liners. It gained Food and Drug Administration (FDA) approval in 2003 and features titanium with grit blasted hydorxyapatite coating [11]. The MDM metal liner engages the Trident shell with appropriate orientation of locking tabs and impaction into a tapered shell [8]. Although there are no reports of incomplete seating of the MDM metal liner there are multiple reports of incomplete seating related to the Trident ceramic metal backed liner [1,2,5,7]. The tapered locking mechanism of the MDM metal liner is similar to that of the metal backed Trident ceramic liner (Fig. 4). The MDM liner has the addition of tabs that are not present on the ceramic liner, however the two liners engage and can be malseated in a similar manner.

Initially reported in conjunction with Trident metal backed ceramic liners, the impaction of the acetabular component during press fit technique is hypothesized to result in

Figure 2. Postoperative portable AP x-ray of the left hip demonstrating incomplete seating of the MDM liner.

Figure 3. Anteroposterior radiograph of the left hip at six months after revision left hip Arthroplasty with MDM liner and no further complications.

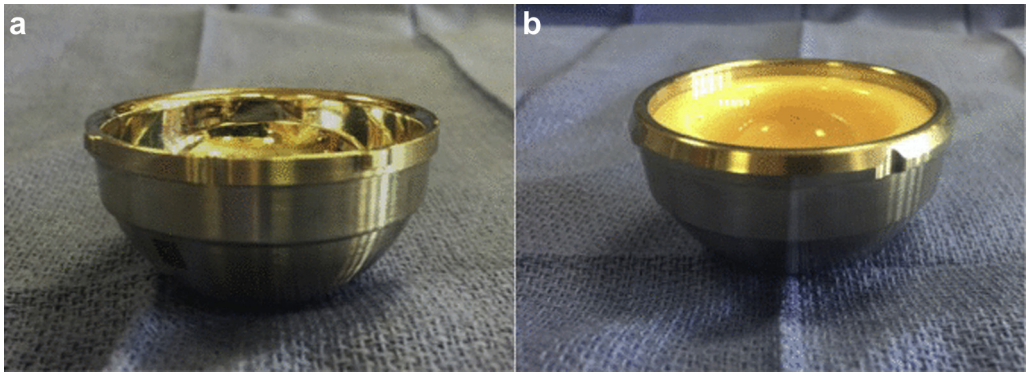

Figure 4. MDM (a) and Trident (b) ceramic liner. Both components have similar grooves and tapered locking mechanism. The MDM liner has the addition of tabs.

deformation of the metal acetabular shell [1–7,12]. This could potentially cause mal-alignment of the cup and liner locking mechanism resulting in improper liner seating. In a study of metal backed ceramic liners with this acetabular component, Langdown et al. reported 16.8% of 117 liners were improperly seated while studies by Howcroft et al., Carvajal Alba et al., and Miller et al. have reported similar findings [1,2,5,7]. Although shell deformation has traditionally been less of a concern with thicker acetabular shells, modern thinner cup assemblies may be at greater risk for this type of deformation [4]. Two studies have evaluated the incidence of deformation following press-fit acetabulum insertion. A cadaveric study using the press fit technique with Trident acetabular shells showed 100% compression deformation with an average of 0.17 mm of pinch deformity [4]. A study of Depuy Pinnacle (Warsaw, IN) acetabular shells also demonstrated a comparable incidence and degree of deformation [12].

Other intraoperative complications can also predispose to incomplete seating. The taper of the liner may be damaged by the insertion technique resulting in deformations in both the liner and shell resulting in seating failure. Soft tissue interposition and subsequent locking mechanism failure is also attributed as a potential cause for incomplete seating [1,2]. For a posterior approach, the inferomedial aspect of the liner is difficult to assess and the presence of loose soft tissue or malseating of the inferior liner and may go unnoticed. This is made further challenging because deformation of the shell or liner can cause the inferior portion of the liner to be malseated while the visible superior portion remains well seated (Fig. 5).

In order to reduce the risk of malseating, surgeons should use intraoperative checks of the inferior acetabulum either physically or radiographically. Prior to insertion, complete visualization of the cup and removal of potential loose tissue is imperative. Both the shell and liner can be checked with an instrument to attempt to dislodge the component or with the use of radiographs. The use of a single intraoperative AP x-ray can detect inferior malseating which is the most likely missed position during the posterior approach, however this can fail to pick up potential anterior or posterior malseating [3].

Summary

This case illustrates canted seating of the MDM metal acetabular liner within an acetabular shell that has a high incidence of incomplete seating with a similar metal backed ceramic liner. Design features of this construct are similar and may predispose

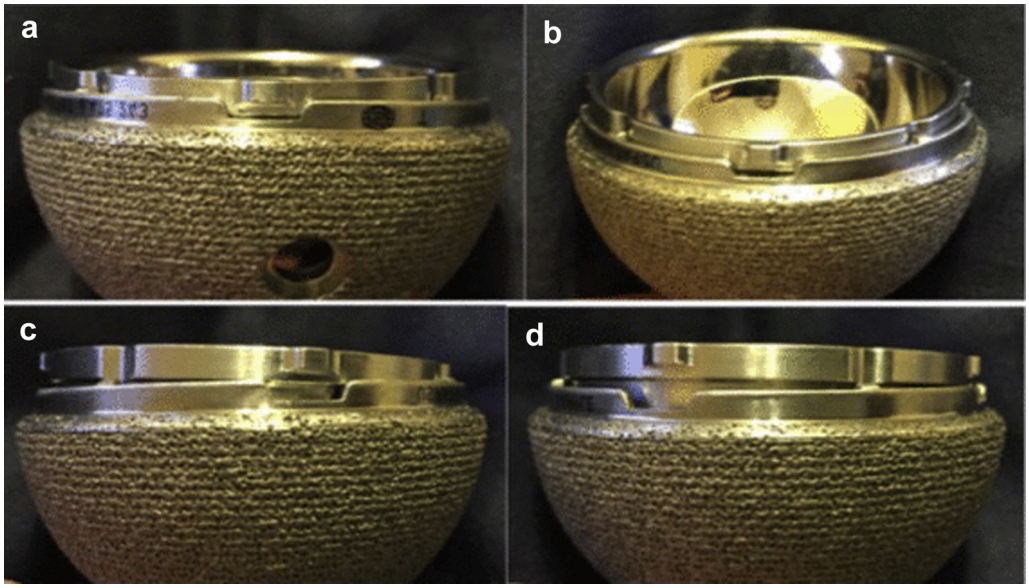

Figure 5. (a and b) (upper row)-Superior view of MDM liner appearing completely seated as would be seen in a posterior approach. (c) (lower left)-Lateral view shows transition from well seated to malseating. (d) (lower right)-Inferior view showing obvious malseating of the liner that can be difficult to detect intraoperatively.

this complication and should be evaluated further while providers should continue to exercise caution during liner placement.

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