CASE REPORT

Incomplete Seating of Modular Dual Mobility Metal Liner within a Hemispherical Acetabular Shell

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ABSTRACT

A 59-year-old male, diagnosed with advanced arthritis of left hip underwent total hip arthroplasty using a modular dual mobility with metal liner. Post-operative radiographs there was suspicion of incomplete seating of the metal liner inferiorly. The patient was reoperated the next day which confirmed the incomplete seating. The metal liner seating was corrected which was confirmed by intra operative visualization and fluoroscopy. Post-operative radiographs showed complete seating of the liner. Periodic follow ups were uneventful. Incomplete seating of dual mobility metal liner especially at the inferior part, though seldom reported is a possible complication which can lead to early failure.

Key Words: Modular Dual Mobility, Metal Liner, Total Hip Replacement, Malseating

INTRODUCTION

The dual mobility cup was developed with a goal to decrease the dislocation rate by associating two articular surfaces: one with a larger diameter situated between a metallic cup and a polyethylene insert, and the other one with a smaller diameter situated between the femoral head and the polyethylene insert.¹

Only one case of seating problem of dual mobility metal liner on trident acetabular shell has been reported so far worldwide.²

Seating malalignment issues associated with various acetabular systems have been well documented in multiple studies, but almost all were involving ceramic acetabular shell liners.³⁻⁹

This case report describes one similar seating malalignment involving dual mobility metal liner and Trident acetabular shell.

CASE HISTORY

59 year old male, presented with pain and difficulty in walking since 9 years. He had a history of childhood fall

followed by limping for some months. A diagnosis of secondary arthritis of left hip was made, for which total hip arthroplasty was performed (**Figure 1**).

Through posterior approach, acetabulum was serially reamed upto 44 and a 46mm (Stryker Trident PSL, Michigan, U.S.) HA cluster shell was impacted (**Figure 2**). One cancellous screw was put in the postero superior

Figure 1. X ray Pelvis – Advanced Osteoarthritis left hip

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Figure 2. Postoperative x ray pelvis AP demonstrating incomplete seating of the metal liner inferiorly

quadrant. dual mobility metal liner of corresponding size (ID 38mm, alpha code D) was impacted into the shell. Liner was visualized to be seated properly all along the edges. Femoral neck cut taken one finger breath above lesser trochanter. Box cut taken, canal identified with a straight reamer. Femoral broaching done sequentially up to size 2 after trial reduction and checking of stability original implantation done using Accolade TMZF uncemented stem 132° neck angle V40 hip stem size 2, neck length 30mm, stem length 115 mm. dual mobility X3 poly insert for dual mobility metal liner ID 22.2mm, 38 mm OD size 38D, femoral head offset -2, OD 22.2mm (V40™ head) were put, joint reduced and assessed for stability and movements. No signs of instability or impingement was noted and wound was closed. Post-operative x ray was taken on the next day, which showed suspicion of incomplete seating of dual mobility metal liner on the acetabular shell.

As the epidural catheter was in place, the patient was taken to operating room, after informed consent. On exposure of

Figure 3. Magnified view - demonstrating incomplete seating of the metal liner inferiorly

Figure 4. X ray after correction

the hip joint, we noticed that superior part of metal liner was seated but there was incomplete seating of the metal liner in the inferior part. However, no component damage was noted. The liner was detached and reinserted, visually confirming the seating superiorly as well as inferiorly. This was further confirmed with intraoperative fluoroscopy

Figure 5. Magnified view after correction

Figure 6. Dual mobility system - Acetabular shell with metal liner and poly insert with femoral head

(Figures 3, 4, 5). The patient was mobilized as per standard protocol from the very next day. At six month follow up, he was walking unassisted with no radiographic abnormality.

DISCUSSION

Dual mobility is designed to help prevent dislocation and aim to achieve stability, longevity in primary or revision total hip arthroplasty.¹⁰

Dual mobility is based on the dual mobility principle with two points of articulation. dual mobility bearings combines two well-known concepts in THA:¹⁰

The Charnley low friction arthroplasty (LFA) prosthesis has demonstrated clinically and radiologically that smaller diameter heads produce lower torque force in the acetabular shell and consequently less wear.^{17,18}

The large head concept from McKee-Farrar recognizes that a large diameter bearing is inherently more stable than a smaller diameter head.¹⁷

The dual mobility system comprises a thin polished cobalt chromium acetabular metal liner that engages the acetabular shell via a taper and articulates with a large diameter highly crosslinked polyethylene (X3) head that encapsulates chrome cobalt or ceramic femoral head.¹⁹ Dual mobility offers stability with its large head and low friction design. It has a three dimensional posterior dislocation distance at 26 degrees of pelvic tilt, a 59% greater jump height with dual mobility compared to a conventional THA with a 36mm head and 81% greater jump height compared to competitive hard-on-hard bearing.²⁰

Dislocation rates of dual mobility systems has been reported to be low with only one study reporting two early dislocations and three dislocations after ten years in a series of 668 cases (Figure 6).¹

Figure 7. Intra prosthetic dislocation - femoral head is eccentric in position inside the acetabular cup

The dual mobility couple mates a fixed femoral head to a mobile polyethylene (PE) liner, which articulates with a smooth metal shell. Thus, there is an inner, small diameter articulation, with a capture mechanism between the head and the liner, and a larger, unconstrained, outer articulation. Because there is an additional bearing interface compared with fixed bearing THA, dual mobility THA can suffer a unique failure mechanism known as an intraprosthetic dislocation (IPD), in which the inner prosthetic femoral head disengages from the outer PE liner. IPD is irreducible by closed means and always require surgical management and dual mobility bearing component revision.¹² Missing this type of dislocation can result in acetabular component damage because the femoral head (metallic or ceramic) articulates directly with the smooth metallic shell, leading to acetabular damage that may necessitate shell revision.^{13,14}

Food and Drug Administration (FDA) approved trident acetabular shell in 2003, and the system is being widely used around with multiple liners. The shell is made of titanium with hydroxyapatite coating.¹⁵

The dual mobility metal liner has a tapered locking mechanism, similar to the trident ceramic liner. In cases of malseating of ceramic liner in trident shell, it has been hypothesized that the shells deform on press fit to the acetabulum.³⁻⁹ This results in malalignment of the liner locking tabs, leading to malseating of the liner.

Studies 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.^{3,4,7,9}

Modern thinner acetabulum shells may be at greater risk for this type of deformation compared to traditionally thicker acetabular shells.⁶

Markel D et al demonstrated the acetabular shell deformation caused by press fit, resulting in an average of 0.17mm pinch deformity.⁶ A study of Depuy Pinnacle (Warsaw, IN) acetabular shells also demonstrated a comparable incidence and degree of deformation.¹⁶

Intraoperative factors which 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 sub-sequent locking mechanism failure is also attributed as a potential cause for incomplete seating.^{3,4}

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.

To prevent the risk of malseating, surgeons should do intraoperative visual checks of the inferior part of acetabular shell and liner either physically or by fluoroscopy. Prior to insertion, complete visualization of the cup and removal of potential loose tissue is important. 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 (**Figure 7**).⁵

SUMMARY

This case report shows that incomplete seating of the dual mobility metal acetabular liner within the acetabular shell is a possible complication. Precaution should be taken with liner placement and correction should be done post operatively if suspected to prevent failure.

END NOTE

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