Summary

Dislocation is a leading cause of revision in total hip arthroplasty (THA). Therefore, care must be taken in identifying patients who may be at risk. Contemporary treatment options include constrained acetabular cups and large-diameter femoral heads. However, dual mobility (DM) cups have emerged as a clinically proven alternative for addressing instability and dislocation. These devices feature three articulations between the acetabular shell, insert, femoral head, and femoral neck. In contrast to other treatments, low friction DM cups avoid neck impingement, while maintaining the intrinsic stability and increased jump distance of a large-diameter bearing. Following a review of the primary DM THA literature, 97.5% survival and a 0.15% incidence of dislocation have been reported at mean follow-up of eight years. In addition, 100% survival and a 0.0-0.22% dislocation rate have been identified for the POLARCUP® (Smith & Nephew, Inc.) at 6.2-7.7 years. The excellent clinical performance of DM cups supports their use as a leading treatment alternative for older patients, or those at high risk for dislocation.

Introduction

There is a clear association between joint instability and increased risk of revision following total hip arthroplasty (THA) [1-3]. Dislocation occurs in approximately 3-7% of all primary THA cases by five years, with the incidence increasing 1% every five years, thereafter [4, 5]. These events can have a profound adverse effect on patient outcome, and may result in significant implant damage. Specifically, dislocation and reduction can lead to impingement between the femoral head and acetabular shell, potentially scratching the bearing surface and accelerating wear [6-10].

Great care must be taken to identify THA patients who may be at increased risk of dislocation. To that end, the following factors have been reported and discussed in the literature [2, 11-14]:

- Advanced patient age
- Female gender
- History of prior hip surgery
- Hip dysplasia
- Tissue laxity or muscle weakness
- Posttraumatic arthritis
- Neurological disease or cognitive deficit
Various THA designs have been introduced to mitigate dislocation risk following implantation. Constrained designs have achieved some success by physically locking the femoral head into the acetabular cup. However, these devices can reduce postoperative range of motion, and can significantly increase wear and failure risk [15, 16]. An alternative, perhaps more common method of improving joint stability is to increase the size of the femoral head. Contemporary large-diameter devices, particularly clinically proven metal-on-metal resurfacing implants [17], can greatly decrease dislocation risk and preserve range of motion [18]. Unfortunately, the clinical indications for these devices exclude at-risk patients.

Alternatively, dual mobility cups represent a safe and effective option for addressing dislocation risk. These devices combine the proven, low friction Charnley THA concept [19] with the intrinsic stability of a large-diameter articulation.

The Dual Mobility Concept

The concept of increasing mobility in THA was formally introduced by Gilles Bousquet and colleagues in 1976 [16, 20]. The fundamental dual mobility design includes three articulations between the acetabular shell, insert, femoral head, and femoral neck (Figure 1). As with standard THA, the femoral head rotates within the liner at the onset of motion (Figure 2A). However, when the stem engages the liner edge during large range of motion activities, the liner rotates, effectively replicating the function of a large-diameter bearing (Figure 2B).

In standard THA, impingement of the neck against the liner would create a lever effect, greatly increasing the chances of dislocation [16]. In contrast, the dual mobility design extends the cone of mobility at this point, while maintaining the intrinsic stability and increased jump distance of a large-diameter bearing [16, 21]. Furthermore, third-generation implants, such as the POLARCUP™ (Smith & Nephew, Inc.), feature a chamfered liner. This modified edge accommodates the neck of the polished femoral stem, reducing the potential for wear at the third articulation [20].

Clinical Performance

The dual mobility concept was initially considered to be a curiosity. However, long-term clinical evidence has established the safety and efficacy of these devices. In a recent expert review, Stroh et al [16] report outcomes from the available dual mobility literature. Eight primary THA studies were identified, with a mean survivorship of 97.5% and a dislocation rate of 0.15% reported at eight years [22-29]. Stroh et al also identified ten years additional revision THA studies, with a mean survivorship of 95.6% and a dislocation rate of 3.5% reported at four years [30-39]. Following a comprehensive review of this evidence, the authors conclude that dual mobility cups offer excellent performance for indicated patients [16].
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Clinical Performance of the POLARCUP®

- Survival of 100% at 6.2-7.7 years [22, 40]
- Low 0.0-1.0% rate of dislocation [20, 23, 40]
- Excellent fixation [41]
- Excellent clinical and functional outcome [41]

Figure 3: Summary of the POLARCUP evidence

References

29. Philippot R, Camilleri JP, Boyer B, Adam P, Fossay M. The use of a dual-articulation acetabular cup system to prevent dislocation after primary total hip arthroplasty: a study of 136 POLARCUP patients. At a mean follow-up of 7.7 years, 100% survival was reported for the flanged cups, as compared to 95% and 91% for press-fit and tripod designs, respectively. A summary of POLARCUP outcomes may be found in Figure 3.

Summary

The excellent clinical performance of dual mobility cups supports their use during primary and revision THA [16, 20, 23, 41]. However, it is important to consider that this concept does not eliminate the risk of aseptic loosening, especially in young and active patients [29]. The articulating surfaces of the insert remain somewhat susceptible to friction and wear [14, 29]. With that consideration, dual mobility is a leading treatment alternative for older THA patients, or for those at high risk for dislocation [16, 29].
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