



Primary Total Hip Arthroplasty and Increasing Modularity: Does One Size Fit All?

Thomas F. Moyad, MD, MPH

Not so long ago, the resurgence of alternative metal-on-metal bearing couples in total hip arthroplasty (THA) was touted by some in the orthopedic community as the solution to polyethylene wear and aseptic loosening. Unfortunately, we now know that every bearing surface and implant design is capable of generating particulate wear debris that can eventually lead to implant failure. Moreover, in recent years, several newly designed hip implants have demonstrated significantly higher failure rates than anticipated, and these implants have subsequently been removed from the market.

The Articular Surface Replacement, a metal-on-metal hip system by DePuy (Warsaw, Indiana), was recently shown to have had significantly higher mid-term revision rates compared with other similar THA systems.¹ Similarly, the Durom Cup by Zimmer (Warsaw, Indiana) is a metal-on-metal THA system that has gained notable attention in the media. Some studies have demonstrated increased early failure rates, and this implant has been voluntarily recalled by the manufacturer.^{2,3} Most recently, Stryker (Memphis, Tennessee) has voluntarily recalled their Rejuvenate and ABG II modular femoral neck hip implant systems secondary to concerns about fretting and corrosion at the modular femoral neck junction. These mechanical processes may result in adverse local tissue reactions, ultimately leading to early implant failure.⁴

EVIDENCE-BASED MEDICINE

What can we learn from these examples? We should always consider the primary factor that guides our clinical decision mak-

ing. Many times, new orthopedic devices are brought to market with the hope of increasing their longevity without proven clinical results. We must strive to remain unbiased and properly inform our patients of the potential for early failure with new technologies that may lack long-term clinical data.

One size does not fit all. Each patient is unique, and each clinical situation deserves thoughtful consideration of the pros and cons of using newly designed implant systems. Using the same implant or bearing couple for every patient may lead to unforeseen problems. For example, some still advocate the use of metal-on-metal bearing surfaces for all their patients. This dogmatic approach may seem to work for many patients; however, it has risks because inevitably some patients will not do well with this approach to implant selection. Some may argue that the use of metal-on-metal bearings in elderly patients facilitates the use of large femoral heads, which effectively increases the jump distance and potentially lowers the risk of dislocation in this higher-risk population. However, the issue of large metal heads and the risk of instability is controversial. Although some evidence exists that femoral head size lowers the risk of dislocation in revision THA,^{5,6} the current evidence is unclear regarding primary THA.

We know that metal-on-metal bearings liberate cobalt and chromium ions that are filtered through the kidneys. Thus, in elderly patients, especially in those with declining renal function, this may be a reason to be cautious or at least seriously consider the pros and cons of using this type of implant. A similar argument can be made for a younger woman who is of child-bearing age or for someone who has a history of metal allergy. In addition, unique complications tend to occur more frequently with metal-on-metal bearings, such as the ALVAL (aseptic lymphocyte-dominated vasculitis-associated lesions) reaction and pseudotumors that can cause significant soft tissue and bone destruction, leading to a challenging revision surgery.

The author is from Sharp Health Care System, La Mesa, California.

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Correspondence should be addressed to: Thomas F. Moyad, MD, MPH, Sharp Health Care System, 5565 Grossmont Center Dr, Ste #3-156, La Mesa, CA 91942 (tmoyad@yahoo.com).

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The objective here is not to criticize a particular type of bearing couple. Rather, the previous example is used to elucidate the following point: every surgeon must evaluate the advantages and disadvantages of using a specific implant design for an individual patient. This is especially true for implants without long-term clinical follow-up.

This leads me to the recent trend of increasing modularity for primary THA systems, in particular the systems that now use modular dual-taper neck junctions. These implants add an additional taper to the femoral stem compared with the more traditional single modular head-neck junction. These double modular neck junctions raise several concerns, including the generation of increased wear debris through fretting and corrosion, cold welding between the stem and modular neck, and fatigue fracture.⁷

Despite a strong industry push for newer designs, enthusiasm for double-taper modular neck junctions now seems reminiscent of the early days of metal-on-metal implants, prior to subsequent reports of early implant failure. Those who support the routine use of dual-modularity stems for primary THA may see the advantages, but are they ignoring the potential pitfalls?

Most hip surgeons would probably agree that femoral stems with increased modularity have some distinct advantages in modern-day revision THA because they allow for greater flexibility in restoring leg length and offset in challenging revision situations. However, the influx of these designs into routine primary THA is more concerning. Patients undergoing revision THA are usually older than those undergoing primary THA. Thus, on average, revision THA patients often expose their implants to less gait cycles than those undergoing primary THA.

Furthermore, notwithstanding complex primary THA such as those with degenerative dysplasia, primary THA is usually less technically demanding than revision surgery. Routine primary THA generally does not require the extra modularity frequently used in revision cases to recreate optimal anatomy and ensure adequate hip biomechanics.

Added modularity at the junction between the femoral neck and stem allows for modest correction of version and leg length, but at what cost? Even tight-fitting cobalt-chromium taper junctions liberate additional wear debris, which may eventually lead to aseptic loosening and implant failure. In addition, the potential for catastrophic femoral stem or neck fracture, particularly in titanium implants, although rare, is another potential concern with these designs.

PREOPERATIVE PLANNING

There is no substitute for thoughtful preoperative planning and careful intraoperative trialing to ensure the appropriate off-

set and leg length. Adding additional modular junctions to allow for greater flexibility in selecting version and neck length during routine primary THA may lead to complacency and must not be seen as an appropriate remedy for poor intraoperative technique. Moreover, the risk of increased modularity may outweigh the benefit, especially in patients who are younger and more active. It is well established that the increased demand and gait cycles placed on hip implants by young, active patients increases mechanical wear debris. Thus, the concern over adding additional sites of wear generation should be taken seriously, and careful consideration is warranted before using these implants. Time will tell whether stems with dual modular neck junctions will fail prematurely or at a higher rate when compared with traditional hip implants.

I plan to heed the advice given to me years ago by one of my mentors: “Be careful that you are never the first nor the last to adopt new technology.” Although modularity of the femoral stem-neck junction is not necessarily a new concept, many current designs still lack proven long-term clinical results.

Theoretical and clinical concerns exist that should cause us to pause for a moment and ask ourselves whether increasing the femoral stem modularity for primary THA makes good sense. Although selective and limited use of dual-taper modular neck junctions for primary THA may occasionally be advantageous, we should always remember that one size does not fit all. ■

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