INTRODUCTION

Prior to 2004, the vast majority of hip replacement implants in the US had utilized a metal ball articulating with a polyethylene (plastic) socket. The friction of the metal ball rubbing on the plastic (polyethylene) socket produced a slow but inexorable wearing of the plastic. The tiny plastic wear particles produced a secondary inflammatory response in the bone and soft tissues. Inflammation in the soft tissues caused soreness. Inflammation in the bone resulted in the formation of cysts in the bone around the implants (called osteolysis). This cystic bone loss was permanent. It often eventually led to implant loosening and/or fracture through weakened bone. Younger, more active, and heavier patients were found to be much more susceptible to the problems of polyethylene wear. Because of these problems, alternative bearing surfaces that might prove more durable were sought.

The result was the development of what was felt to be a bearing surface that would be much more durable, the metal-on-metal hip. Though in use for several decades in Europe, the metal-on-metal phenomenon in the US really began in the early to mid 2000s when the FDA granted approval for its use. Because of the great initial enthusiasm that arose for the use of the metal-on-metal bearing hip replacement (“the hip for a lifetime”) from both patients and surgeons, implant manufactures rushed to develop many new designs to meet this new demand.

METAL-ON-METAL BEARING SURFACE

Unfortunately, not all of the new metal-on-metal designs were well conceived. Improperly designed implants caused excessive metal ion shedding. The excessive metal ions caused many of the same problems of soft tissue inflammation and osteolytic bone cyst formation as did the plastic particles, but in a dramatically more accelerated and destructive fashion. As a result of problematic design issues, two of the largest implant manufacturing companies had major recalls. Not all metal-on-metal designs followed this path to early catastrophic failure. In fact, some designs appear to be functioning as planned creating no symptoms, no signs of wear, or no excessive metal ion shedding despite years of heavy use.

However, as class action law suits against manufactures abound, and as uncertainty exists in regard to which metal-on-metal design criteria might work, and with new developments in the form of innovative wear-resistant plastics, the American Academy of Orthopedic Surgeons and the FDA has suggested hip surgeons impose a moratorium on further implantation of all metal-on-metal designs. Thus at this time, most hip surgeons have ceased (at least temporarily) implanting metal-on-metal hip replacements.
SPECIAL NOTE TO MY PATIENTS: The majority of my metal-on-metal hip replacement patients have had implanted the Biomet Magnum Tri-spiked metal-on-metal design. This implant has not been recalled. There have been few metal ion issues in patients with this system implanted. And to date I have performed very few revisions on the hundreds of patients who received this particular joint. In addition, Biomet has procured technology so as to make revision surgery to a metal-plastic bearing surface, if necessary, an extremely simple and straight-forward procedure with minimal risk to the patient and limited down time in terms of recovery. It is recommended that all patients with metal-on-metal implants have annual x-rays to ensure no early hidden problems have arisen.

CURRENT BEARING SURFACE RECOMMENDATIONS

Given that the metal-on-metal bearing surface is no longer recommended, the question remains as to what then is the best, most durable option for the young active patient who will by lifestyle and activity level put the most wear on the joint.

Ceramic-on-Ceramic Bearing: The use of ceramic-on-ceramic designs has been popular in some centers. But ceramic is a form of glass and difficult to manufacture when working with the complex design of the socket (the simpler design of the spherical “ball” side of the joint has not been a problem). There have been problems of ceramic implant fracture, squeaking (so loud as to necessitate revision surgery) and an increased risk of dislocation because the socket is shallower.

New Generation Wear Resistant Polyethylene (Plastic): Fortunately, the last decade has seen the emergence of an improved, more durable polyethylene. Clinical studies have clearly shown that the new plastic, called “cross-linked polyethylene”, is truly more wear resistant. Indeed, the wear rate appears to be so slow that some surgeons started recommending its use over metal-on-metal even before the metal ion problems became apparent. And when articulated with a ceramic instead of a metal ball, the wear rate of the plastic to wear is even further diminished. This is due to the fact that the ceramic surface is smoother resulting in less friction than its metal ball counterpart.

An added benefit of the more durable cross-linked plastic is the freedom it gives manufacturers to design a thinner socket that can then articulate with a larger, greater diameter ball. The larger femoral head size increases hip stability and lowers the risk of dislocation thus minimizing the need for “hip precautions” in almost all patients.

Current Recommendation: The best bearing surface for the young, active patient who will put significant wear on the hip replacement appears now to be the use of a ceramic “ball” articulating with the new wear resistant “cross-linked” polyethylene socket. This construct has now been in use for a decade, so precise determination of length of survivorship is somewhat speculative. However, there is evidence that this bearing surface could last up to 20 years or more before a revision of the plastic might be necessary.

CONCLUSION

Metal-on-metal hip replacements gained popularity a decade ago in a desire to eliminate use of the plastic (polyethylene) socket. However poor design features by two large implant manufacturers led to many revision operations,
implant recalls, and class action litigation. This has tainted the perception of all metal-on-metal implant designs, even those that are clinically apparently successful. As a result, there is currently a moratorium in the US regarding implanting metal-on-metal implants. Fortunately, with the development of the new wear resistant “cross-linked” polyethylene, an alternative is available for young active patients that will function well and be durable over many years.

Figure 1. Metal-on-Metal hip replacement. The metal ball articulates with the metal socket.