Controversies in Hip Replacement

Total hip surgery has been extremely successful, with patient satisfaction rates of well over 90%. Hip replacements can be placed with or without bone cement, but because uncemented implants have been so successful, there is no longer controversy about their use. Most hip sockets are replaced with uncemented implants, since these have been shown to be more durable and to be easier to revise than cemented sockets. While there has been a trend to the use of uncemented stems in most patients, cemented fixation is still an excellent choice for patients with poor bone, more advanced age, and for some anatomical situations. There continues to be much more discussion in hip replacement surgery in the following areas, which are described in more detail below for those who are interested:

- Bearing Surfaces
- Surgical Approach (including Minimally Invasive Surgery)
- Computer Assisted Surgery

Bearing Surfaces

There are a variety of bearing surfaces which are used in total hip replacements. These include:

- Metal ball on polyethylene socket
- Ceramic (or ceramic equivalent) ball on polyethylene
- Ceramic ball on ceramic socket
- Metal on metal socket

All of these surfaces have advantages and disadvantages, but all can be expected to provide a durable well functioning implant. Hip surgeons continue to try to improve the durability of the bearing surface, because many of the late failures of hip replacements are due to problems arising from the bearing surfaces. If you are interested in learning more about bearing surfaces, please feel free to read on.

The most common bearing surface is a metal ball articulating with a plastic socket. The ball is usually a chrome-cobalt alloy, and the plastic is a high molecular weight polyethylene. New techniques (cross-linking, vacuum packing) have made the plastic much more durable, and virtually all the plastic used nowadays is so-called cross-linked polyethylene. Polyethylene liners are usually placed into a metal shell which is attached to the bone of the hip socket. These liners have the advantage of modularity, that is, different liners of different shapes and sizes can be placed into the shell, and the surgeon can use these options to reproduce the geometry of the hip and to make the hip joint more stable (less likely to dislocate). The main disadvantage of polyethylene is that there are breakdown particles of the material which cause a local tissue reaction. The body cannot absorb these particles, so the particles accumulate over time. The body's response to these particles can range from minimal reaction to a dramatic reaction, which can lead to a condition called “osteolysis,” in which the bone around the hip can be damaged.

Ultimately, plastic failure and osteolysis can result in a painful implant which may need to be revised.

To reduce the rates of wear, especially for patients with a long life expectancy, alternative bearing surfaces can be used. Ceramic balls are often used with a polyethylene socket, since laboratory investigations have shown reduced generation of polyethylene particles with this articulation. Ceramic balls have some disadvantages, in that they cannot be made in as many sizes as metal balls, and there is a small risk of fracture of the implant, although the rate of fracture is very small. One of the manufacturers (Smith & Nephew) uses a proprietary technology to produce a material called Oxinium, which has
Ceramic type properties with metal strength. This implant has shown excellent results, but if the ceramic type layer is damaged, then the implant may not be as effective in reducing wear.

Any articulation with polyethylene will produce some amount of polyethylene debris, so manufacturers and surgeons have tried to eliminate polyethylene from the hip joint. This can be done with a ceramic on ceramic or a metal on metal articulation. The big advantage of these articulations is the elimination of polyethylene wear particles. There are disadvantages, however. When ceramic or metal is used on the socket side of the joint, there are fewer options to help make the joint more stable. The design of the ceramic liner inside a metal shell has undergone changes to reduce wear along the edge of the ceramic, where chipping and cracking can occur, and because the ceramic liner is so hard, there can even be wear of the metal of the femoral stem if it contacts the edge of the ceramic liner. Ceramic fractures can occur, but are rare. There have been reports of an audible squeaking coming from ceramic on ceramic articulations which have been quite disconcerting to patients. With metal on metal articulations, there can still be generation of metal debris, although this is less common with new manufacturing techniques. The metal on metal surface does produce metal ions which can be measured in the blood stream, and have been found in organs like the liver and spleen. However, there is currently no evidence for any harm caused by these ions. Still, it will take many years for there to be long enough follow up to be certain that the ions are safe, and hip surgeons do not recommend placing these implants into women of child-bearing age. There is a concern that some patients will have or develop sensitivity to the metal, and there is currently no way to predict if an individual will have such sensitivity.

The orthopedic community is continuing to work on new bearing surfaces and combinations of bearing surfaces. For example, there are clinical trials underway to see if a ceramic on metal articulation will incorporate the advantages of both so-called hard surfaces, but reduce the risk for metal ion formation and the risk for chipping and cracking.

**Hip Resurfacing**

In the past several years, there has been a resurgence of interest in hip resurfacing. In a standard total hip, the top part of the femur bone is removed, and the metal implant is placed about 6 inches into the marrow cavity of the femur. In hip resurfacing, more of the femur bone is preserved, and a metal cap is placed on the top of the femur. Hip resurfacing has been available for more than 30 years, but most studies have shown that standard hip replacements are superior for most patients. Newer surgical techniques and improvements in manufacturing have improved the outcomes of the hip resurfacing operation. At present, the implant system which has had the best intermediate term results (5 to 10 years) has been the Birmingham Hip Resurfacing system from Smith & Nephew. Developed in Birmingham, England, this implant includes a cemented cap on the femur bone, and a metal shell which is press-fit into the pelvic socket.

The surgery allows the use of a bigger ball, which more closely reproduces the size of the normal hip ball. As a result, there may be a lower dislocation rate and a greater range of motion, and because the joint is only resurfaced, there is less risk for creating a limb length difference. Proponents of this operation have suggested that patients can be more active, including being able to participate in impact sports. If the implant were to fail, the revision of this implant should be easier, at least theoretically, because there is still enough bone in the top of the femur to place a standard hip replacement.

This implant has a metal on metal articulation, and it suffers from the same concerns regarding metal ions and metal hypersensitivity which were discussed above. The surgery is actually more technically challenging and it requires a larger incision and more soft tissue dissection. It cannot be used in cases where there is significant bone deformity or if there is a...
large difference in leg lengths. It cannot be used if the bone is weak, because there is a greater risk for a fracture of the femoral neck after this operation.

Although the intermediate results are very good, they are still not quite as good as the results for standard total hip replacements. For all these reasons, the current recommendation is to limit the use of this implant to young patients with excellent bone quality and minimal deformity. Practically speaking, this usually means patients around the age of 50, or younger. Women over the age of 60 have been shown to have the highest rate of femoral neck fracture following this surgery, so older women are not usually good candidates for this operation. Questions remain about this surgery, including rates of late femoral neck fracture as patients grow older, and about avascular necrosis, or death, of the remaining hip bone, which can cause component loosening.

Surgical Approaches (including Minimally Invasive Surgery)

The goals of hip replacement surgery are to provide long lasting pain relief and improved function to patients with hip disease. Current joint replacements are able to achieve these goals for the vast majority of patients. These goals can be accomplished by approaching the hip through several well described and tested surgical approaches. There has been a great deal of interest in so-called minimally invasive surgery (MIS), which use smaller surgical incisions. Theoretically, these smaller approaches can allow a faster recovery. Because less tissue is divided, there may be a lower rate of dislocation. Candidates for MIS are usually patients who are thinner and have minimal hip deformity.

Some studies suggest that these smaller approaches can, in some cases, facilitate a faster recovery, but other studies have shown that the speed of recovery is more dependent on the age and fitness of the patient, and on the postoperative rehabilitation program, than on the size of the incision. While most of the studies have shown good success with the smaller incisions, there is some evidence to suggest that there could be increased complications with smaller incisions, including higher rates of skin and nerve injury, higher rates of intraoperative fractures, and a higher rate of component malposition. Note that no studies have shown better long-term outcomes with the use of minimally invasive surgery.

Regardless of the surgical approach, hip replacement patients can expect a well functioning hip in the vast majority of cases. Preoperative hip exercises, fitness, and normal weight can contribute significantly to the rate of recovery. At Kaiser Santa Clara, we are working to incorporate accelerated rehabilitation methods into our postoperative protocols to allow patients to have a faster recovery.

Posterior Approach

The standard posterior approach, also called the posterolateral approach, is carried out through an incision on the side of the thigh extending onto the buttock. It is classically described as being an incision of 8 to 12 inches, although most surgeons do not make the incision quite this long any more. This approach is the most commonly used surgical technique used for placement of a total hip replacement. It is safe and leads to good results. In this approach, the main muscles of the hip joint are either separated or moved out of the way, but some of the smaller muscles (the external rotator muscles) are divided from the back of the thigh or femur bone. These tissues are usually repaired at the conclusion of the operation. There is a risk of injury to the sciatic nerve which is close to the back of the hip joint, and there is a risk for posterior dislocation of the hip (in which the hip can come out of the back of the joint), so after surgery, precautions are needed to prevent this dislocation until the tissues heal.
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One variation of the posterior approach is a small posterior approach, which uses an incision which is about 4 to 6 inches long. This is the MIS posterior approach. Posterior approaches are most commonly used at Kaiser Santa Clara.

Anterior Approach

The hip may also be approached through the front, or anterior side, of the joint. The hip is less likely to dislocate out the back, so limitations on hip bending are not usually needed after surgery. The hip could still dislocate out the front of the joint. The sciatic nerve is less at risk, but another nerve, the femoral nerve (which supplies the thigh muscle), can be injured, and an important skin nerve which supplies the sensation on the front and side of the thigh can also be injured.

In one of these approaches, the anterolateral approach, the incision is made on the side of the thigh, but the surgeon enters the joint from the front. It allows a smaller incision, good exposure, but it requires partial division of the gluteus medius muscle, which is the most important hip muscle. Some studies have shown a higher rate of persistent limp with this approach.

An anterior approach can also be made directly from the front of the hip. This approach does not divide the gluteus medius muscle and it is designed to be made between muscles to minimize muscle injury. This approach has a MIS variation, and a special table is used to help manipulate the thigh bone so the surgeon can get access to it. Currently, there are no surgeons at Kaiser Santa Clara who are using this approach.

Two Incision Surgery

In this approach, two small incisions are used, including a small posterior incision and a small anterior incision. Surgeons use a portable x-ray machine in surgery to allow visualization of the implant position. The main proponent of this approach, Dr. Richard Berger of Chicago, Illinois, has demonstrated the ability to send patients home even on the day of surgery, and sometimes without walking aids! Unfortunately, when this approach was tested by a group of experienced hip surgeons at Kaiser Oakland, they found an unacceptable rate of complications, so they have abandoned this approach. We do not currently recommend its routine use.

Computer Assisted Surgery

One of the newer technological advances has been the use of computerized navigation systems to help with placement of implants in both knee and hip replacement surgery. While consistent use of these systems can improve accuracy in the positioning of implants, there is not yet good evidence that the outcomes for the patients are improved.

There are risks with using these systems, including added surgical time, and there are reports of fractures occurring through the holes in the bone which are needed in order to temporarily attach the navigation instruments to the bone. As a result, computer navigation is not routinely used for joint replacement by most surgeons, although it can be especially helpful if there is a significant bony deformity which limits the use of standard bony landmarks.