Hip Resurfacing Arthroplasty: A Review of the Evidence for Surgical Technique, Outcome, and Complications

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KEYWORDS

• Hip • Resurfacing • Surface • Replacement
• Arthroplasty • Metal-on-metal • Alternate bearing

Many patients seek hip arthroplasty earlier in life to remain physically active rather than accept the limitations of their hip arthritis. This younger patient demographic will likely require additional hip surgery because the life expectancy of patients in their 40s and 50s will most likely exceed 30 more years.[1] As a result, the lack of established longevity for standard bearing (metal-on-polyethylene) total hip arthroplasty (THA) and the need for future revision of THA in this younger patient population has prompted the use of alternative bearing surfaces and fueled the resurgence of hip resurfacing arthroplasty.

The first hip resurfacing procedures (large metal head articulating with high-molecular-weight polyethylene) performed in the 1970s resulted in an unacceptably high wear rate resulting in failure secondary to osteolysis (ie, aseptic loosening or inflammatory bone resorption).[2–4] Despite this initial failure, efforts have been made to improve surgical technique, instrumentation, and implant design.At present, there are several hip resurfacing implant systems available; however, only the Cormet (Corin, England) and Birmingham hip resurfacing systems (Smith and Nephew, Memphis, TN, USA) are approved by the Food and Drug Administration for use in the United States.[4]

MODERN IMPLANT DESIGN

Current hip resurfacing implants use a metal-on-metal bearing surface, with implants forged or cast from high-carbon cobalt-chromium-molybdenum alloy. If the femoral and acetabular implants are well-manufactured and well-positioned, large-diameter metal-on-metal bearing surfaces are predicted by lubrication theory to produce very low levels of volumetric wear compared with the metal-on-polyethylene surfaces used in the past.[5–9]

Hybrid fixation (press-fit acetabular and cemented femoral components) is most commonly used. A cementless acetabular cup is typically press fit into the under-reamed acetabulum. The acetabular cup has a surface modification of cobalt-chromium beads or plasma-sprayed titanium with or without hydroxyapatite coating for bone in-growth and fixation.[10,11] The femoral

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component is traditionally cemented into place on the femoral neck. There are, however, cementless designs being used because of the potential for thermal bone necrosis during the cement curing process, contributing to early implant failure.[12–15]

SURGICAL TECHNIQUE

There is no ideal surgical approach for hip resurfacing arthroplasty.[16–21] There is a balance between the risks of surgical dissection and necessary exposure and visualization. Femoral head oxygen concentration is compromised in both the anterolateral and posterior approaches. However, during the anterolateral approach and not the posterior approach, femoral oxygen concentration recovers after implantation with hip relocation (**Table 1**), suggesting compromise of the ascending branch of the medial circumflex femoral artery during release of the short external rotators during the posterior approach.[22,23] However, a posterior approach used in surgical dislocation that protects the tendon of the obturator externus and consequently the ascending branch of the medial circumflex femoral artery has no risk of femoral head osteonecrosis (see **Table 1**).[24,25] Retrieval studies demonstrated osteonecrosis of the remaining femoral head in 10 of 14 failed hip resurfacing arthroplasties using the posterior approach; 9 underwent revision for femoral neck fracture, and 1 underwent revision for femoral component loosening.[26]

Preparation of the femoral head by reaming is enough to decrease blood flow to the femoral head by 70% in 9 of 10 hips.[27] This is likely a result of disruption of the nutrient retinacular vessels of the femoral head because 80% of these vessels penetrate bone in the anterosuperior and posterosuperior quadrants of the femoral neck.[28] Valgus positioning during reaming results in notching of

Table 1
Established technical considerations during hip resurfacing arthroplasty and their corresponding highest level of evidence

Technical Considerations	Evidence	Citations
The anterolateral approach preserves the blood supply to the femoral head	Level III, B	22
The extended posterior approach compromises the blood supply to the femoral head	Level IV, B	23,26
An obturator externus tendon sparing posterior approach does not compromise the blood supply to the femoral head	Level IV, B	24,25
Reaming of the femoral head decreases blood supply to the femoral head	Level IV, B	27
Femoral neck notching decreases blood supply to the femoral head and is associated with femoral implant loosening	Level IV, B	29,30
A cement mantle more than 3 mm is associated with femoral implant loosening	Level IV, B	12
Filling of bone cysts greater than 1 cm^3 is associated with femoral implant loosening	Level IV, B	12,62
Lesser trochanteric suction cannula can control femoral temperatures during cementing	Level III, B	13
A varus stem-shaft angle less than 130° correlates with adverse outcome	Level III, B	35
Hip resurfacing arthroplasty cannot dramatically affect limb length or horizontal femoral offset	Level III, B	39,40
Biomechanical reconstruction of the hip is comparable to THA with hip resurfacing arthroplasty if minimal initial deformity is present	Level I, A	41
Acetabular bone loss is similar to that of THA	Level I, A	39,42
Acetabular component abduction angle of greater than 55° can increase wear	Level IV, B	12,15
Femoral bone stock is preserved and may be converted to THA	Level II, B	44,45,48,49

Level of evidence *Data from* the *Journal of Bone and Joint Surgery* (I–IV) and the *Orthopedic Clinics of North America* (A or B).