Hip Resurfacing: Current Limitations and New Solutions

Medical implants have to comply with a steadily increasing multitude of regulations to demonstrate safety and performance. Metal-on-metal hip resurfacing arthroplasty (HRA) devices are associated with metal related pathologies, and due to the concerns related to their unique risks and problems identified in the medical device reporting systems and recalls, this type of implant is subject to increased scrutiny from regulatory bodies. To date there are two metal-on-metal HRA's approved by the FDA and three approved under a CE mark in Europe. Hip resurfacing with metal implants is still possible but is limited to well-selected patients and generally performs best in males. Use of ceramic in hip resurfacing avoids the metal-related pathologies observed with metal-on-metal hip resurfacing devices. Ceramic, a material with excellent biocompatibility, allows hip resurfacing to once again become a realistic option for patients with good bone stock.

Resurfacing as Alternative to Total Hip Arthroplasty

Hip resurfacing arthroplasty was developed as a bone and tissue-sparing alternative to total hip arthroplasty (THA) providing a more anatomical hip reconstruction. In the case of HRA revision, a primary THA device can be used, potentially delaying the total joint replacement in patients by decades. Until recently, only metal-on-metal (metal-on-metal) implants were available for HRA. Such HRA systems have been subject to metal (Cobalt Chromium Molybdenum, CoCrMo) related problems which may now cause surgeons to question their views on the existing and the potential advantages of this type of implant. In young male patients, HRA has yielded excellent results according to a study of the International Hip Resurfacing Group:

"Overall cumulative Kaplan-Meier survivorship was 88.9% at 22 years (95% CI: 88.3–89.5%). 2 HRA designs (…) led to inferior results while all others yielded similar survivorships. Excluding (these), implant survivorship in 11,063 cases was 95% at 10 years and 90% at 22 years. In men, implant survivorship was excellent: 99% at 10 years and 92.5% at 21 years. In females, implant survivorship was 90% at 10 years and 81.3% at 22 years. The overall revision rate was 3.6% with most common reasons for revision being implant loosening and adverse local tissue reactions. The best survivorship was found in patients with osteoarthritis (95% CI, 92.1–93.3% at 22 years), the poorest was among dysplastic hips (78.3%; 95% CI, 76.5–80.1% at 20 years, $p < 0.001$)."[1]

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Hip Resurfacing: Current Limitations and New Solutions (continued)

Conceptual advantages

The advantages of HRA are well documented with perhaps the most important being preserving of the structure of the femoral head and neck, more reliable restoration of leg length and offset than in THA, a more anatomical femoral loading with stress shielding consequently reduced and the potential to delay the need for a THA. The risk of early dislocation is lower by a factor of 2 to 4. In patients with HRA on one side and THA on the other, the HRA limb accepts more weight and pushes off with greater force in gait analyses. The 2014 guidance issued by the National Institute of Health and Care Excellence (NICE) of the UK considers (metal-on-metal) HRA suitable for patients whose life expectancy exceeds the expected lifetime of THA devices and who probably will need a revision procedure. Delaying the first full-fledged THA by up to 20 years or more results in a higher quality of life for the patient and significantly lowers the cost and risks of a later revision. As health care providers follow regulations and strive to avoid risks, these advantages are mainly reserved for young, active male patients. It is not apparent that HRA has a lower survival rate than a conventional THA in male patients with good bone stock at any age. Evidence now emerging also suggests that latent mortality is lower following HRA than THA in equivalent patients.

Ceramic options

The Australian Register Report of 2020 states that 'metal related pathology is the most common reason for revision after 7 years' for HRA. Using ceramic instead should therefore minimise the major risks and contraindications for HRA.

Ceramic components have the potential to make the advantages of HRA accessible to a wider range of patients including females. Ceramic-on-ceramic HRA has the potential to change practice and outcomes of hip arthroplasty significantly. Today, two ceramic-on-ceramic HRA systems are in the process of clinical evaluation*. Both rely on BIOLOX®*delta* material which has been widely used in hip arthroplasty since 2003, defining a benchmark for ceramic materials in arthroplasty in general.

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