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Original Research Article

Hip Resurfacing Arthroplasty- Will it Stand the Test of Time?

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Abstract

The current metal-on-metal hip resurfacing as an alternative to traditional complete hip replacement in younger people constitutes the third generation of resurfacing, with enhanced metallurgy, better designs, and improving operating procedures. Short- and medium-term results are good to exceptional, but long-term results are awaited. Some obvious theoretical benefits of the method include bone stock preservation, ease of revision, when necessary, a more natural gait pattern, and larger ranges of movement. However, as evidenced by numerous research, these have not been fully achieved. Critics of this technique have identified various concerns, including a unique cause of failure involving the neck of the femur, a steep learning curve for aspiring surgeons, and the unknown significance of elevated ions levels. The lack of a specific approach for determining metal allergy. Many surgeons believe that the hazards outweigh the benefits.

Keywords: Hip Resurfacing, Metal Allergy, Natural Gait Pattern, Hazards

Background

Hip resurfacing arthroplasty (HRA) is a prosthetic hip replacement procedure that attempts to treat hip osteoarthritis (OA) with only a partial resection of the femoral head. The notion has been popular among youthful and active patients, owing to the procedure's ability to preserve femoral bone [1]. Furthermore, the build is said to be more stable than 28- or 32-mm total hip arthroplasty (THA) components due to the near-anatomical diameter of the articulating surface [1,2]. As a result, HRA is thought to restore human anatomy and physiology more accurately than traditional THA.

When indicated, hip resurfacing arthroplasty is usually advised in healthier and younger patients with less medical complications. In contrast to standard total hip replacement, hip resurfacing arthroplasty often necessitates more soft tissue releases and surgical dissection, which might result in higher blood loss [3-

5]. In many institutions, measuring haemoglobin levels prior to and just after surgery are standard therapy during the perioperative period associated with significant interventions such as hip joint replacement. The objective for such measurement is to aid in the identification of anaemic individuals who may benefit from allogenic blood transfusion.

However, there are hazards connected with allogenic blood transfusion, and as a result, there is a growing movement to rationalise the use of this limited resource [6,7]. Because of a stronger physiologic capacity to handle with modest volume blood loss, the numerical value or relative reduction in haemoglobin levels around the time of surgical intervention is frequently of less clinical relevance in younger and healthier demographic groups [7]. In these cases, clinical observations of symptomatic anaemia led the decision to proceed with blood transfusion [5,7]. Postoperative haemoglobin levels, particularly in younger patients without major medical comorbidity, should be regarded as a relative reference to overall patient assessment and therapeutic management rather than an absolute predictor of the need for blood transfusion [8].

Relatively young individuals with osteoarthritis owing to DDH may be candidates for hip resurfacing. However, Amstutz *et al*. recently reported poor results of resurfacing for Crowe Types I and II DDH in terms of femoral component durability [3]. Knecht *et al*. observed good functional benefits with resurfacing, but the short follow-up of only 1.5 years prevents meaningful inferences from being drawn [9]. The anatomic anomalies present reconstructive obstacles when conducting arthroplasty in dysplastic hips [4]. Furthermore, increasing degrees of dysplasia, greater adductor muscle contractures, abductor muscle insufficiency, femoral antetorsion, and limb-length discrepancies all contribute to an aberrant gait pattern that is frequently found in these patients [10]. Because of these variances, patients with DDH may have different outcomes.

Advantages and disadvantages of resurfacing

Possible advantages

All research on hip resurfacing report lower dislocation rates. Dislocation rates in conventional THR have been reported to range between 2 and 7 percent. Dislocation rates in resurfacing, on the other hand, are 0.21 percent [11]. A senior surgeon experienced only two dislocations in 1486 patients in one series, both of which were related to technical issues [11]. As the components (called implants) used in hip replacements and hip resurfacings are mechanical pieces that wear out or loosen over time, hip resurfacings may be easier to update. This usually happens between 15 and 20 years following the treatment, though implants can survive longer or shorter [12]. If an implant fails, a second operation may be required. This second treatment is known as a revision, and it can be more complicated than the first.

Many surgeons believe that because hip resurfacing takes less bone from the femur (thighbone) than standard hip replacement, it is easier to replace implants that fail following hip resurfacing [13]. When the femoral component of resurfacing fails, the surgeon has a convenient fallback choice due to the preserved bone stock and ease of revision to a traditional THR. Many people have not noticed this on the acetabular side. In contrast, most people believe the opposite is true [12,13].

According to several researches, walking patterns are more natural after hip resurfacing than after standard hip replacement [14-16]. However, these changes in walking are relatively small, and specific devices are required to quantify them. A broader range of motion has been suggested as a benefit [15]. This has been reported by some authors, whereas others have found no change.

A more natural walking pattern has been suggested as a benefit. Some writers found it similar to 'normal' individuals when examining gait patterns with metrics such as walking speed, abduction moments, and ease of negotiating bends or uneven surfaces. Shimin *et al* [16] discovered that the gait pattern was no different from that of a typical THR. When large head THR was compared to gait patterns and resurfacing hips were more identical to small head THR. When employed for proximal femoral abnormalities such as DDH, perthes, or retained hardware, resurfacing has apparent advantages since the surgical time spent on hardware removal is decreased [11, 16]. If necessary, additional operations like as osteotomies can be performed at any point.

Possible disadvantages

Resurfacing is a significantly more technically challenging treatment that should not be attempted without proper training and supervision. A steep learning curve is a major detriment. Moonot *et al* [10] experienced 11 femoral neck revisions and 2 revisions due to technical flaws in his first 50 cases, and then 1 # NOF and 1 revision in the next 50. Lachweicz *et al* [17] colleagues discovered that only 6% of THR cases were optimal for resurfacing. Other related contraindications included inflammatory arthropathy, limb length disparity, and unquantified aberrant proximal femoral anatomy.

Femoral neck fractures are a problem that is exclusive to resurfacing. A tiny percentage of individuals undergoing hip resurfacing will eventually break (fracture) the thighbone at the femoral neck [17]. If this occurs, the hip resurfacing is usually converted into a standard hip replacement. Because the femoral neck is removed during the treatment, a femoral neck fracture is not conceivable with a standard hip replacement. However, with a typical hip replacement, fractures surrounding the implants are still possible. Shimmin *et al*. [16] colleagues found a 1.5-2 percent incidence of # of the femoral neck in a review of the Australian joint registry, noting that technical flaws such as implant varus alignment or notching accounted for 85 percent of the cases. Complication rates reduced from 13.4 percent to 2.1 percent and femoral neck # fell from 7.2 percent to 0.8 percent when more severe exclusion criteria were used to exclude subjects with osteopenia, BMI > 35, big cysts in the head, and also avoidance of intraoperative notching of the neck.

A metal ball travels within a metal socket during hip resurfacing. Friction between the two surfaces can cause the release of microscopic metal molecules known as ions over time [18]. The ions can trigger an unfavourable local tissue reaction in the bone and soft tissues surrounding the joint. This can result in pain and edoema, as well as the necessity for revision surgery. Ions can enter the bloodstream and cause systemic effects. As a result, hip resurfacing is now used less frequently than in the past.

Contemporary resurfacing

Resurfacing is technically more complex than traditional THA, and each step of the surgery, beginning with the surgical approach, is prone to surgical mistake. Several case studies show that superior skill and experience resulted in lower revision rates and higher functional outcome scores [2,3,19,20]. This, however, was not detected in another big series. Surgery-related characteristics have a significant impact on implant survival on the femoral side. Zustin *et al*. [21] examined 107 femoral head remnants after fracture at a mean of 5 months after implantation. Three fracture forms were observed, each with a different causal reason. Acute nonnecrotic fractures (9%) occurred outside the component and were most likely caused by mechanical weakening of the bone, which is caused by notching or uncovering of the bone, which is more common in smaller sizes. Acute post-necrotic fractures (52%) occurred after an average of 5 months. Chronic non-necrotic fractures (40%) occurred at a mean of 6 months and could

have been caused by factors such as component varus placement or relative neck lengthening caused by excessive polar cement [21].

Third generation resurfacing implants are now being placed with better and more accurate equipment. Improved metallurgy has enabled the production of more polished surfaces with higher resistance and wear characteristics [13,20]. Cementing procedures have also progressed significantly since the days of manual mixing and thumbing. Hybrid procedures comprising a cemented acetabular component with a press fit femoral component made of either metal on metal or ceramic on ceramic are quickly becoming the accepted standard [15,19]. However, some challenges with these modern implants, including as metallurgy, bearing surfaces, fixation techniques such as bone-implant bonding, operating techniques, and other specific concerns, persist.

Durability

Patients treated with HRA have higher postoperative activity levels and quality of life scores than their THA counterparts, even after adjusting for pre-operative activity levels [22-24]. According to one study, HRA patients returned to work (96%) and heavy to moderate activities (72%), whereas THA patients did not (66 percent and 39 percent, resp.) [22]. However, both groups were not totally similar because the HRA group's mean BMI was much lower [24]. Amstutz *et al*. [3] discovered in a case series of 923 patients that women improved more in walking, function, and the SF-12 mental component, whereas males improved more in activity after an average follow-up of 7 years.

HRA can increase final flexion by 17° to 32° compared to preoperative levels [9, 13]. Incavo *et al.* [25], on the other hand, demonstrated in a cadaver study that there were considerable abnormalities, with 2 (25%) hips having deficits in extension and 7 (88%) hips having impairments in flexion - both of which were normal with THA [25]. In these HRA surgeries, osteochondroplasty of the resurfaced neck was not considered, but a decreased head-neck offset has been linked to a lack of flexibility [7,17].

A head-to-neck ratio of 1.4 should be attained with a normal resurfacing component, and some surgeons consider femora with a head-neck ratio less than 1.2 to be unsuitable for resurfacing [9,22]. Osteochondroplasty could be used to try to establish an optimal head-neck offset [12], however this can be challenging to achieve in HRA [23], in which case appropriate cup orientation becomes more crucial to optimise range flexion [23,24]. According to one study, 42 percent of patients had a limb-length difference after surgery, compared to 23 percent pre-operatively [8,14].

Conclusions

Previous generation resurfacing failures have been demonstrated to be attributable to improper materials, poor metallurgy, and defective surgical procedures. The third generation is still in its infancy, and long-term results must be sought before it can be considered an option. If it is to be extensively used, the high learning curve must also be addressed. Long-term repercussions of unique properties such as increased metal ions, ALVAL, and so on will require more investigation.

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