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On Fixation of Hip Resurfacing Implants

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ABSTRACT

Hip resurfacing became a recognized entity in hip replacement in the 1970’s. This
generation of resurfacing implants was abandoned due to loosening and debris. The
interest in resurfacing was renewed due to the need of a bone conservative solution for
young active patients with osteoarthritis, and a new generation metal on metal (MoM)
resurfacing implants was introduced in the late 1990’s using the same alloy as in earlier
MoM total hip replacements (THR’s). Although sharing similar resurfacing features,
they could differ in aspects such as fixation method, design features and manufacturing
process.

Radiostereometric analysis (RSA) is the golden standard method to study micromotion
in hip and knee implants; early micromotion is a strong indicator for loosening and
poor long term survival. No RSA studies had been performed on earlier MoM THR’s.
This meant that it was important to perform RSA studies on the new MoM resurfacing
implants. In Studies I-II, RSA examinations were performed on the Birmingham Hip
Resurfacing Implant (BHR), to investigate whether translation and or rotation occurred
early postoperatively (Study I) and at mid term (Study II). In Study III, a two year RSA
follow-up was performed on the Birmingham Mid Head Resection (BMHR) implants.
The results demonstrated stable implants during the periods studied, indicating that
fixation and stability should not contribute to eventual failure.

One MoM resurfacing device, the Articular Surface Replacement (ASR) was recalled
from clinical use in 2010 due to inferior outcome. Femoral head implant loosening and
femoral neck fractures indicating instability of fixation were dominant causes at short
term. The cementing technique for ASR fixation (high viscosity (HV), indirect)
differed from the technique used for clinically successful resurfacing implants (low
viscosity (LV), direct). Study IV was an investigation using a cadaver model, to clarify
morphological differences between the HV and LV cementing techniques on ASR
implants. The results demonstrated a superficial fixation with the HV technique, which
in traditional hip and knee implants has been demonstrated to be favourable, but may in
the ASR be insufficient to maintain adequate stable fixation.

The use of the resurfacing method has declined since the ASR withdrawal, although
other issues concerning the long term effects of elevated ion levels also contributed to
the decline. The ASR experience underlines the importance of thorough studies of
factors such as migration and wear before general market introduction of new implants.

Key words: Hip resurfacing, hip arthroplasty, radiostereometric analysis, implant
fixation, implant migration, cementing techniques, metal on metal, BHR, BMHR,
ASR.