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CORR Insights®: Does the Risk of Rerevision Vary Between Porous Tantalum Cups and Other Cementless Designs After Revision Hip Arthroplasty?

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Where Are We Now?

Though known for its conservative attitude toward new implants, the use of primary tantalum cups is on the rise in Sweden. And while it is of some concern that two tantalum cup designs showed slightly inferior survival when used as a primary implant [14], the literature generally suggests tantalum cups perform well when used in revisions. After 3–6 years of followup, numerous such studies have shown low frequency of loosening [1, 5, 6, 8, 10–12].

Might porous tantalum offer additional benefits? Trabecular metal cups have not shown any superiority based on implant survival when compared to older uncemented cups with porous coating [10, 15]. And although trabecular metal cups may be slightly superior to cups coated with titanium fiber mesh [3], more evidence is still needed before any definitive statements can be made regarding trabecular metal's risk or revision.

Some studies suggest that tantalum may reduce the risk of infection. In a cell-culture study, Schildhauer and colleagues [12] found that the bacterial adherence of *Staphylococcus aureus* was lower to pure tantalum than to five other metals or metal alloys including titanium. Tokarski and colleagues [15] studied 990 hips revised with either a titanium or a tantalum acetabular cup and found that revision due to infection was less common in patients who received a tantalum cup at the index operation. They suggested that tantalum might be associated with a decreased risk of reinfection because of better osseointegration and a bacteria-repellant surface structure.

Where Do We Need to Go?

Despite the availability of prudent recommendations on the evaluation and introduction of new orthopaedic implants [9], there are numerous

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examples where these approaches were not followed, sometimes with poor or even disastrous results [2, 4, 7, 8, 13]. Why is this important to the conversation about highly porous metal cups? Trabecular metal cups and porous titanium cups have been phased into clinical practice without much evidence showing superiority to implants currently on the market, and it remains unclear whether they can reduce the revision burden. A more structured, safer, and faster way to obtain reliable information about new implants is desirable, and could be accomplished through biomechanical testing. If new materials and/or surface structures are introduced, studies on biocompatibility, wear, and creep should also be performed. Preferably, such evaluations should include studies of implanted prostheses in laboratory animals.

Retrospectively evaluating revision implants is generally more complex than primary procedures because the patient in need of a revision generally suffers from additional comorbidities and variable degrees of deformity or bone loss. Additionally, the use of bone grafting, augments, reinforcement rings, types of articulating material, and surgical technique varies between hospitals and even between surgeons and finally also with time as practices change. All of these factors represent confounding variables in any analysis pertaining to survivorship of revision THA components. The high number of cases usually included in register studies might to a certain extent compensate for these problems, but selection bias and confounding due to other factors can often not be completely compensated for, even when regression analysis is performed, and even when researchers apply sophisticated matching procedures.

How Do We Get There?

Multicenter, randomized studies are ideal, but in revision surgery, such studies are rare and difficult to conduct. Perhaps randomized studies using national registries is a more realistic goal [9]. To make such a study operable it probably has to become block randomized with each participating unit inserting either the implants belonging to the study or the control group. It should be emphasized that before embarking on a study of revision cases, a new implant should first be studied in primary cases. As pointed out above revision cases are more heterogeneous with varying degrees of bone defects, with varying reasons for revision which as such will influence outcome, have in general more comorbidities and modified implants and variations of the surgical technique are often necessary. These factors will complicate data evaluation and might even hide or at least delay detection of any implant related differences, especially if they are comparatively small.

We need further studies with long-term followup to determine whether trabecular metal cups can help us better manage severe bone defects. Preferably, such studies should include well-documented implants in the control group representing today's standard of care. Well-performed, multicenter studies preferably monitored by an independent National or Regional register will probably be necessary in order to detect variations in patient characteristics or a surgeon's performance.

We must go beyond simply looking at large-scale use when identifying poorly performing implants. Randomized studies with contemporary methodology is a good first step for identifying potential benefits and problems related to a new device. To facilitate implementation, block randomization should be performed, if possible. However, such studies might not identify rare issues, case-mix variations, or variations in surgical technique. Therefore, restricting the release of new devices to only a well-defined number of centers that monitor adverse events possibly related to the implant should be considered. In many countries where this approach to new

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implants has made a difference, the process itself was initially not dictated by governmental rules and restrictions but was governed by the orthopaedic profession.

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