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CORR Insights

CORR Insights®: Primary Ceramic-on-ceramic Total Hip Arthroplasty Using a 32-mm Ceramic Head with a Titanium-alloy Sleeve

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Where Are We Now?

Ceramic-on-ceramic bearings have become a popular alternative to conventional polyethylene in THA. The major advantages of ceramic bearings for THA include their scratch resistance, low coefficient of friction, less-reactive particulate debris, and superior wear resistance. Dating back to the 1970s, ceramic bearing failures were primarily related to aseptic implant loosening and catastrophic ceramic fractures [1]. In the 1990s, a new generation of alumina ceramic bearings became available with higher quality and greater burst strength [3]. They were also mated with implants that had excellent fixation records and high taper tolerances. Despite these advances, ceramic fracture, neck socket impingement, and squeaking remain a current concern. Fracture risk is increased with smaller diameter femoral heads, malpositioned sockets, and the presence of trunnion debris and/or damage. Impingement and squeaking are typically related to implant position, design, and material properties.

A more recent concern is the use of larger diameter femoral heads on smaller trunnions. Larger-diameter femoral heads carry a greater risk of fretting corrosion and adverse local tissue responses (ALTRs). Retrievals and in vitro studies [4] have found less fretting corrosion at the head neck junction with ceramic femoral heads compared to metal heads. The addition of a Ti sleeve within the ceramic head decreases the potential risks of fracture from trunnion debris and or damage. However, the metal sleeve raises some concern regarding the potential of fretting corrosion and ALTRs.

In the current study, Lim and colleagues reviewed alumina ceramic bearings utilizing a titanium alloy sleeve within the modular ceramic femoral head with a minimum 5-year followup. Currently, clinical studies utilizing alumina ceramic bearings without Ti sleeves have minimum 10-year followup [2, 5]. The principal issues to compare are survivorship revision for any reason, ceramic fracture, and incidence of osteolysis. The authors reported a 97% survivorship for revision for any reason. This is similar to survivorships ranging from 95% to 99% found by others [2, 5].

This CORR Insights® *is a commentary on the article* "Primary Ceramic-on-Ceramic Total Hip Arthroplasty Using a 32-mm Ceramic Head with a Titanium-alloy Sleeve" *by Lim and colleagues available at:* DOI:10.1007/s11999-015-4374-y.

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Where Do We Need To Go?

Despite the presence of the Ti sleeve, a fractured femoral head (0.36%) occurred 6 years after surgery. The major ceramic manufacturer (CeramTec) estimates alumina ceramic fractures worldwide to occur in 0.026% of hips [6], but prior work suggests a higher fracture risk as much as 2%. Ceramic fracture, although rare, remains a concern. The presence of osteolysis in this series at an average of 6 years followup is also of some concern because previously published work suggests that the presence of osteolysis with minimum 10 years followup is rarely seen [2, 5]. This is an important study group of patients that needs to be followed for more than 10 years. It remains to be seen whether the longer-term survivorship, fracture risk, and incidence of osteolysis all support the benefits of adding a Ti sleeve within the ceramic femoral head. Retrievals of these implants for any reason will yield important information regarding fretting corrosion at the Ti sleeve trunnion junction.

Biolox® Forte (CeramTec AG, Plochingen, Germany) alumina ceramic hips have proven excellent survivorship beyond 10 years followup [2, 5]. Another possible avenue, of course, remains the development of new materials that may help minimize or eliminate old problems. Biolox® Delta (CeramTec AG, Plochingen, Germany) may be one such material that warrants a careful evaluation.

How Do We Get There?

Even with the success of alumina ceramics, the risk of catastrophic fracture remains (and in large part is) related to surgical technique. Failure to properly position implants and restore biomechanics can lead to fractures. Edge loading, trunnion debris and or damage, as well as failure to properly seat and secure the ceramic components to either the femoral or acetabular implant can increase the fracture risk. Future development of surgical assist devices to accurately position implants and restore biomechanics will further improve overall survivorship. Currently, metal and/or ceramic on highly crosslinked polyethylene (HXLPE) also have low wear and high survivorship. Prospective randomized trials comparing Biolox® Delta to Biolox® Forte will determine the real versus theoretical benefits for a ceramic-on-ceramic bearing, use as a ceramic femoral head on HXLPE, and use with and without the addition of a Ti sleeve within the ceramic femoral head.

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