Title | Effect of inner taper angle of the acetabular metal shell on the malseating and dissociation force of ceramic liners.
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Level of Evidence | None given.
Summary | The common taper angle of acetabular shells for ceramic liners is 18°, however, for acetabular shells with multibearing options (metal, polyethylene, ceramic) the taper angle is lower. Lee et al. compared the disassociation force, as well as the incidence of malseating ceramic liners, in two different 52 mm acetabular shell designs, which of which included a different taper angle. Insertion and push-out tests were performed in a laboratory setting on two types of acetabular shells with either 18° (Exceed ABT, Biomet) or 10° (Pinnacle, DePuy) taper. Three experienced high volume arthroplasty surgeons participated in the insertion tests. Each used 3 metal shells and 30 ceramic liners (BIOLOX® delta) of each design. Metal shells were press-fit into Sawbones blocks. For the push-out experiment the components were assembled manually and impacted with a 2 kN compression force. A load was applied through the hole at the apex of the shell and the maximum force to disassembly was recorded. No malseating of metal shells with an 18° taper was observed. Conversely all 3 surgeons had several malseated liners with the 10° taper (8, 6 and 8/30, respectively). The dissociation force from 10° compared to 18° shells was almost 3 times higher (1,148.8±46.7 N and 389.7±108.3 N, respectively). The authors caution about malseating of ceramic liners, which may negatively affect the outcome of an all ceramic bearing.
Study Limitations | Only one design per group, shell angle was confounded by other design changes, such as shell thickness, surface roughness; and design may play a role. Factors such as taper length or roughness were not included.
Only one size of metal shell was tested. Experimental set-up with Sawbones, study was not blinded or randomized. Relationship between shell deformation and malseating was not evaluated.
Key Messages | The risk of malseating a ceramic liner is significantly higher for metal shells with a 10° taper compared to metal shells with a 18° taper. Surges should be always be cautious about malseating of ceramic liner. There may be design factors, such as taper angle, that may complicate effective seating of the liner. The dissociation force (push-out) of ceramic liners in metal shells with a 10° taper was almost 3-times higher than in shells with an 18° taper.
Commentary | This is the first study to suggest that the risk of malseating of ceramic liners may be shell design dependent, and that taper angle may be an important design variable. This is a concern regarding the function and fracture risk of ceramic liners, if not correctly placed by the surgeon. Unexperienced surgeon should perform specific lab training and use appropriate insertion tools.