## Executive Summary

**Issue 3-2017**

**Title**  
Stem taper mismatch has a critical effect on ceramic head fracture risk in modular hip arthroplasty

**Authors**  
J. Gührs, M. Körner, M. Bechstedt, A. Krull, M. M. Morlock

**Journal**  
Clinical Biomechanics 41 (2017) 106–110

**Level of Evidence**  
None applicable. Laboratory study.

**Summary**  
Mixing and matching of modular neck/ceramic heads from different manufacturers can lead to an increased risk of head fracture. Gührs et al. from Hamburg investigated component mismatch, using non compatible components from two implant providers, which seemed to provide a stable fixation during assembly. They hypothesized that the fracture resistance of ceramic femoral heads is reduced due to the taper angle mismatch.

The angular mismatch between the stem tapers and alumina ceramic femoral heads was 1.69°, which is approx. 17 times larger than the commonly tolerated taper angle difference from one manufacturer. The tapers were assembled and pre-loaded with 2kN (axial). Axial loading tests to fracture were performed according to ISO 7206-10 with a constant displacement rate of 0.04mm/s.

The fracture load for the mismatched ceramic femoral heads was 23.68kN, which is almost only 50% of the minimum fracture load of 46kN recommended by the FDA for ceramic heads. The fracture load was still higher than hip joint forces during stumbling; however, axial loading does not pose a worst case scenario in-vivo. Also, in contrary to correctly matched components the contact pattern (circular metal transfer on the inner taper of the ceramic head) was much smaller and concentrated at the proximal end of the taper.

The authors conclude that modular component mismatch should be avoided to prevent patients from the higher risk of ceramic fracture. Only component combinations approved by the same manufacturer should be used.

**Study Limitations**  
Different mismatch parameters were not evaluated separately.

Only angular mismatch was evaluated.

Tests were performed with alumina ceramic only.

**Key Messages**  
Only use component combinations from the same manufacturer.

Quote: "Mixing and matching components can put patients at greater risk for ceramic head fracture and must be avoided at all costs".

Mismatch still can provide a subjectively stable taper connection. However, it may still reduce the fracture resistance of ceramic components.

**Commentary**  
This study adds scientific evidence to not mix and match modular head-taper components from different implant providers. An important finding was that even if this taper connection seems stable after assembly it can still decrease the fracture resistance of alumina heads substantially.