

## ***Quelques recommandations sur l'usage des Céramiques en Orthopédie***

« La relation entre la résistance mécanique des céramiques  
et la qualité de l'interface métallique »

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### **Ceramics in orthopaedics tips and tricks**

“Relation between metal interface conditions and the burst load of ceramic components”

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Ceramic ball heads are well known for their outstanding properties in terms of wear resistance and burst loads which are significantly higher than the maximum in-vivo loads acting on the human hip. Nevertheless, occurring in-vivo fractures of ceramic ball heads are a cause for concern and are often explained by the brittle nature of ceramics.

This paper shows that the in-vivo metal taper conditions strongly influence the actual in-vivo burst load of ceramic ball heads.

Ceramic ball heads made of pure alumina as well as alumina matrix composites have been loaded until burst strength under various metal taper conditions. Parameters under investigation are greased and wetted tapers as well as damaged tapers. Additionally, theoretical and numerical calculations are used to explain and support the experimental findings.

The experimental results clearly exhibit the strong influence of the metal taper conditions on the burst load, which in some cases decrease to the range of maximum in-vivo loads. The reduction of the friction coefficient due to greased and wetted conditions of the metal taper leads to significantly higher hoop stresses within the ceramic ball head lowering significantly the burst loads. Damaged tapers may lead to point loads which are stressing the ceramic locally, therefore, exceeding the burst strength under certain conditions. The theoretical and numerical calculations support these findings for greased and wetted taper conditions as well as for damaged tapers.

A carefully cleaned metal taper is necessary for sustaining the high burst loads of ceramic ball heads that are measured in-vitro under best experimental conditions. Hence, it has to be pointed out that the burst load of ceramic ball heads is not a material intrinsic parameter but is strongly influenced by its environmental conditions. Good taper conditions are essential for the ceramic ball heads to fully use their strength abilities.