Monthly **CeraNews**

The Orthopaedic Landscape Information Newsletter, Issue 8 / 2017

CoC shows excellent long-term results

Ceramic-on-ceramic (CoC) bearings made of third-generation ceramics (BIOLOX®*forte*) show excellent long-term results in a study from Italy. Overall survivorship after 15 years with revision as endpoint was 93.2%; considering implant failure as endpoint the figure was 97.2%. **Toni et al.** analyzed 248 cementless THA with 28mm CoC bearings in 235 patients with a mean age of 55.5 years at the time of surgery. All stems were made of titanium alloy, with a modular titanium alloy neck.

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Significantly lower noise incidence with navigation

Computer navigation can help to position implants appropriately, leading to a significantly reduced incidence of noise for CoC bearings. **Shah et al.** came to this conclusion after analyzing 173 conventional and 202 computer-navigated THA. The risk of reported noise was lower by a factor of 2.7 in the navigated subgroup examined and lower by a factor of 5.8 for noises other than squeaking. Radiographic comparison showed that cup anteversion was significantly lower for squeaking than for silent hips.

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XPE wear study wins award

This year's Heinz Mittelmeier Research Award was granted to **Dr. Constantin Mayer** and colleagues from Düsseldorf/Essen (Germany) for a study on wear kinematics of conventional and crosslinked polyethylene. Analyzing X-rays, they found that wear patterns are similar for both materials. They recorded an alarming rise in the wear rate of the crosslinked PE after nine years post-op. The study also showed elevated wear rates in male patients and with large bearing diameters.

The study has been accepted by the Journal of Arthroplasty.

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Avoid taper contamination!

Contamination between stem taper and femoral head reduces the pull-off force for metal as well as ceramic femoral heads. Fatty contamination causes severe, saline only a small reduction, as **Krull et al.** found out. Cleaning and drying with gauze after contamination improved pull-off strength to values similar to the pristine condition. The authors concluded that drying after cleaning is beneficial for avoiding a large variation in taper fixation.

The study examined the effect of taper contamination and cleaning on head taper fixation. Cobalt-chromium (CoCr) and ceramic (Ce) femoral heads were impacted by a standardized method. Five conditions were investigated: pristine, contaminated with fat, cleaned after contamination with fat, contaminated with saline and cleaned after contamination with saline. Pull-off forces in pristine conditions were similar for both head materials (Ce: 2'272 ± 337 N, CoCr: 2'288 ± 248 N). Contamination with fat had a dramatic influence on the pull-off forces (Ce: 26 ± 16 N, CoCr: 28 ± 21 N). By contrast, saline caused only a small reduction in pull-off strength. Cleaning and drying with gauze after contamination with either fat or saline solution yielded pull-off forces close to those of pristine tapers. The authors concluded that intraoperative taper contamination with fat or saline solution has a major impact on the taper fixation strength.

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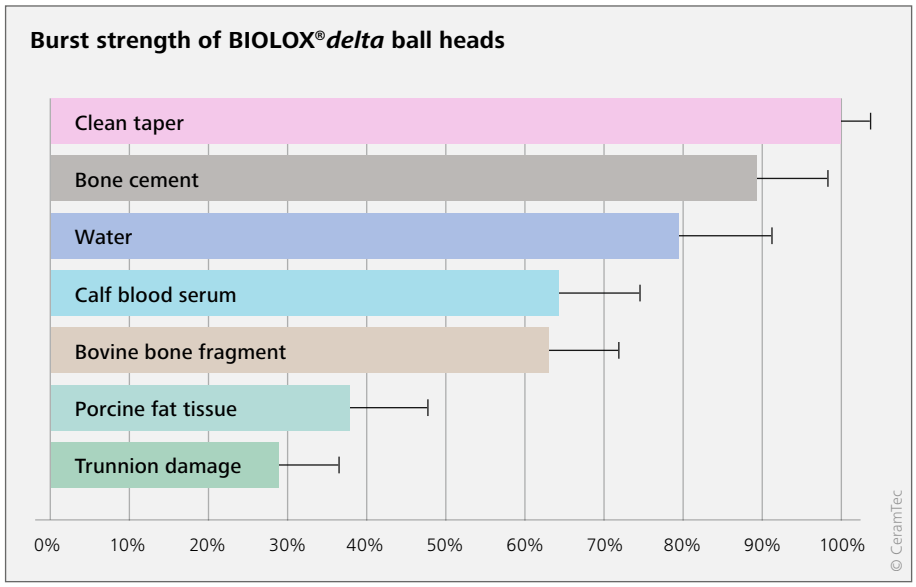
The taper contamination affects the burst strenght



The burst strength of BIOLOX®*delta* ball heads is reduced when these materials contaminate the stem taper.

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MT-00178-1709-EN-01

Executive Summary

Issue 8 / 2017

Title	**The influence of contamination and cleaning on the strength of modular head taper fixation in total hip arthroplasty**
Authors	A. Krull, M.M. Morlock, N. E. Bishop *Institute of Biomechanics, University of Technology & Department of Medical Technology, University of Applied Sciences, Hamburg, Germany*
Journal	J Arthroplasty 2017, May 13. pii: S0883-5403(17)30415-1. doi: 10.1016/j.arth.2017.05.009. [Epub ahead of print]
Level of Evidence	Not applicable, laboratory study
Summary	**Krull et al.** examined the effect of taper contamination and cleaning on head taper fixation. Cobalt-chromium (CoCr) and ceramic (Ce) femoral heads were impacted with a mean assembly force of 4.3 kN by a standardized method onto commercially available titanium alloy stems. Five conditions were investigated: pristine, contaminated with fat, cleaned after contamination with fat, contaminated with saline and cleaned after contamination with saline. A quasi-static pull-off test was performed to determine the axial disassembly force. Pull-off forces in pristine conditions were similar for both head materials (Ce: 2'272 ± 337 N, CoCr: 2'288 ± 248 N). Contamination with fat had a dramatic influence on the pull off forces being significantly lower compared to pristine tapers, comparable for both head materials (Ce: 26 ± 16 N, CoCr: 28 ± 21 N). Contrary saline caused only a small reduction in pull-off strength for both materials (Ce: 1'911 ± 1'637 N, CoCr: 2'010 ± 1'827 N). Cleaning and drying with gauze after contamination with either fat or saline solution yielded similar pull off strength compared to pristine tapers for both materials examined. The authors concluded that intraoperative taper contamination with fat or saline solution has a major impact on the taper fixation strength. They further concluded that drying after cleaning is important for avoiding a large variation in taper fixation.
Study Limitations	Pull-off strength not representative for clinical assembly strength
	Large scatter in contaminated results; standard deviations almost as large as the mean values for contaminated surfaces
	Different geometrical parameters (e.g. angular gap) and surface structures of tapers and ball heads were not examined
Key Messages	**Taper contamination strongly affects taper fixation strength**
	Huge scatter in the fixation strength of contaminated tapers if not clean and dry
	No difference between ceramic and metal heads
	Cleaning the stem taper with saline and gauze and drying with gauze is very effective to achieve almost pristine pull-off strength
	Intraoperative cleaning and drying of tapers is an important step to guarantee sufficient taper fixation strength
Commentary	Basic scientific paper that confirms clinical experience findings. Contamination is well known to reduce the burst strength of ceramic femoral heads and also the stability of the taper connection of modular hip prosthesis. With respect to the increased potential of fretting and tribo-corrosion optimal assembly of modular connections is one of the key factors for reducing its incidence, especially when metal heads are used.

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Executive Summary

Issue 8 / 2017

Title	**3rd generation alumina-on-alumina in modular hip prosthesis: 13 to 18 years follow-up results**
Authors	A. Toni, F. Giardina, G. Guerra, A. Sudanese, M. Montalti, S. Stea, B. Bordini *Rizzoli Orthopaedic Institute, Bologna, Italy*
Journal	Hip Int 2017 Feb 21;27(1): 8-13. doi: 10.5301/hipint.5000429. EPub 5002016.
Level of Evidence	Level IV (Case series)
Summary	**Toni et al.** analysed 248 cementless THAs with 28 mm CoC bearings (BIOLOX®*forte*) in 235 patients with a mean age of 55.5 years at time of surgery. All stems were Ti-alloy with a modular titanium alloy neck. Primary diagnosis was mostly primary osteoarthritis (57.3 %) followed by osteoarthritis due to developmental dysplasia (23.8 %), and others. Mean follow-up was 16.5 years, ranging from 14-19 years. The Merle-D'Aubigne and Postel hip score was used for clinical assessment. At final follow up it had improved significantly from 11.4 to 17.4. Overall survivorship after 15 years with revision as endpoint was 93.2 %; considering prostheses failure as endpoint it was 97.2 %. Early complications such as pulmonary embolism was found in one patient and early posterior dislocation in three hips, which were treated by closed reduction without recurrence. Only one acetabular component was not stable and revised. On the femoral side 10 stems were initially rated fibrous stable, only one of which had to be revised later due to loosening. Periprosthetic partial radiolucent lines were found in 17 cases but remained asymptomatic. There were 4 cases (1.6 %) of squeaking (2 intermittent) and 3 cases of ceramic liner fracture after about 5 years. Two of the squeaking cases were linked to ceramic liner fracture. In the 3 patients with a fractured ceramic liner posterior neck-to-cup impingements was identified as a reason during revision and implant position was changed during the intervention. The authors conclude that the use of 3rd generation CoC bearings in cementless THA, in their hands, provided excellent long-term results comparable to the results of the clinical literature with CoC bearings if the implant components are positioned correctly and functionally stable. However, although squeaking does not seem to be a problem for the patient, it may be a sign for impending ceramic fracture mid to long-term, if the position of the components leads to neck-liner impingement.
Study Limitations	Retrospective observational cohort study from a single center without control group
	Sequela of noise and fracture is not proven
	All cases from a single surgeon
Key Messages	**Cementless THA with 3rd generation 28mm CoC bearings can provide long-term clinical results survivorship of 93.2 % - 97.2 %**
	Neck-cup impingement should be avoided to reduce the risk of ceramic fracture and squeaking
	Squeaking may be an indicator of later ceramic liner fracture in cases of impingement
Commentary	This is another long-term, single-center retrospective observational cohort study with 3rd generation CoC bearings THA. The reported survivorship in this case series was similar to other recent CoC publications, despite using modular necks and 28 mm bearings. An issue with the 28 mm head CoC bearing in this publication seems to be the appropriate positioning of the implant with neck-liner impingement and consequently liner fracture. Nevertheless, experience of other authors with CoC does not confirm that noise is a predictor of pending ceramic failure, but is rather the consequence of a fracture.

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Executive Summary

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Title	**Computer Navigation Helps Reduce the Incidence of Noise After Ceramic-on-Ceramic Total Hip Arthroplasty**
Authors	S.M. Shah, K. Deep, C. Siramanakul, V. Mahajan, F. Picard, D.J. Allen *Department of Orthopaedics, Golden Jubilee National Hospital, Clydebank, UK*
Journal	The Journal of Arthroplasty 2017, Online May 2017. http://dx.doi.org/10.1016/j.arth.2017.04.019
Level of Evidence	Level III (Retrospective comparative study)
Summary	**Shah et al.** evaluated 375 ceramic-on-ceramic (CoC) total hip arthroplasties (THA) with mostly 32 mm head size, comparing 173 conventional versus 202 computer navigated implantations. Three surgeons performed the conventional procedures, and all navigated procedures were performed by a single, different surgeon. All patients received the same implant type with a BIOLOX®*delta* head and liner. They were interviewed about noise occurrence, and if yes what kind, onset, activities causing it and association with pain. No patient in either group required revision for noise. Noise was reported in 14.7 % THAs, of which 7% were non squeaking noise such as click, grunt, grind or crunch. In the navigated group, noise was not associated with pain and only noises other than squeaking were associated with pain in the conventional THA group (5 patients). Activities reportedly associated with noise were 61 % bending, 15 % climbing stairs and 14 % rising from a chair. Gender, BMI and head size were not significantly different between silent and noisy THAs. Patients aged < 65 years had a significant greater incidence of self-reported noise. A subgroup was analyzed for further comparison between 118 conventional and 68 navigated THAs. Subgroup analysis suggested that navigated CoC THAs have a significant 2.7 x lower risk for reported noise and 5.8 x lower for noises other than squeaking, not significantly different in the conventional vs. the navigated group (p = 0.2). Radiographic comparison showed that cup anteversion was significantly lower for squeaking hips compared with silent hips but cup inclination, femoral offset and total offset were similar. The authors inferred that computer navigation helped to position implants appropriately and this leads to a significantly reduced incidence of noise for CoC bearings. However, the confounding between surgeon and treatment group, as well as unmatched patient factors, greatly complicate the association of navigation with reduced noise.
Study Limitations	Possible selection bias regarding age receiving CoC bearings
	Confounding by surgeon (no overlap in surgeons between two study groups, all navigated procedures performed by a single surgeon)
	Information on noise based on patient perception and subject to recall bias (subjective)

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Executive Summary

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Key Messages	**Overall incidence of noise in THA with CoC bearings was 14.7 %; 7.7 % squeaking**
	Computer navigated CoC THAs were associated with less self-reported bearing noise, but not lower incidence of reported squeaking
	Cup anteversion was significantly lower in squeaking hips compared with silent hips
	Squeaking was not associated with pain
	No revisions for noise
Commentary	To appropriately restore 3D hip anatomy, computer navigation was used as a tool to control cup orientation, center of rotation, stem anteversion, offset and leg length during surgery. Additionally computer simulation may help estimating the risk of impingement of the implant during ambulation. However, structural limitations in this study design limit the association between surgical navigation and patients' self-reported noise. Patients reported that movements like bending down or climbing stairs were associated with noise emission, thus it seems appropriate implant positioning based on patient specific anatomy can help to reduce the risk of its occurrence. Higher cup anteversion seems to reduce the risk for noise occurrence, especially squeaking. Because of the confounding in the present study, it remains unclear whether appropriate placement, or the use of navigation, is most likely responsible for reduction in bearing noise. Ideally a prospective randomized trial would be the best way to answer this question, rather than by comparing case series from different surgeons using different component placement strategies.

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