

## EFORT 2017 in retrospect

### Less biofilm on ceramics

There is significantly less biofilm mass on retrieved ceramic (34%) than on polyethylene (98%) and metal surfaces (66%). During the recent EFORT 2017 congress, **Trampuz et al.** updated their report on their large prospective multicenter explant study. Their findings potentially reflect special characteristics of ceramics, which seem to resist bacterial adhesion.

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### More PJI with metal

MoXP bearings are associated with a significantly higher risk of revision for PJI than CoC bearings (hazard ratio 1.42) in patients younger than 70 years when cementless femoral components are used. **Madanat et al.** presented their conclusion from Australian registry data of 177,237 primary THA procedures over a 14-year period during the recent EFORT 2017 congress.

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### Higher mortality with PJI

Varnum et al. analyzed the data of 68'504 primary THA from the **Danish Hip Registry**, of which 445 were revised for PJI and 1350 were exchanged for other causes within the first year after primary implantation. The authors found that revision for PJI is associated with a mortality risk 2.18 times higher than in the reference group of all THA patients in the first post-operative year and 1.87 times higher than in the aseptic-revision group in the first year following revision surgery.

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## Benign fluid collection not uncommon

Fluid collection is not uncommon in asymptomatic patients with well-functioning CoXPE bearings. However, they are probably benign and without clinical consequence. **Jennings et al.** drew these conclusions after examining MRI scans of 44 patients (50 hips). 9 hips showed visible fluid collections, 5 hips manifested intracapsular synovitis with a mean synovial thickness of 5.1mm. Two of these were considered to have a thickened synovium (>6mm). 4 hips showed extra-articular fluid collection with intracapsular communication with a mean synovial thickness of 6mm. Two of these were considered to have a thickened synovium.

No tissue destructions or solid lesions were found. There were neither indications of implant loosening nor other signs of adverse local tissue reaction (ALTR). Nevertheless, the patients should be monitored closely in case the fluid collection progresses from benign to symptomatic or to even causing destructive lesions, the authors pointed out. 3 hips showed signs of potential early osteolysis. The osteolytic lesions may have been subclinical cystic lesions, which could not be identified on the preoperative radiographs.

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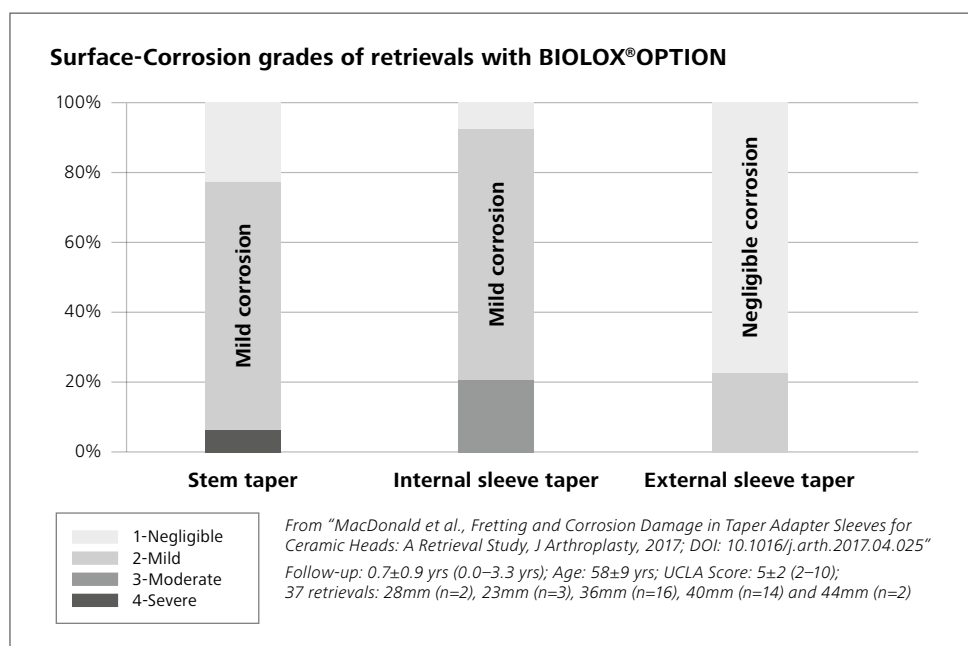
## Minor tribocorrosion with sleeves

Tribocorrosion can also occur with sleeved ceramic femoral heads. However, it is predominantly mild and lower than with metal heads. **MacDonald et al.** conducted a retrieval study of 37 BIOLOX®OPTION sleeved ceramic heads (titanium alloy, BIOLOX®delta ceramics). There was no difference in surface damage of the interface between heads used for primary and for revision surgery. According to the authors, sleeves are a reasonable solution for solving the dilemma with stems remaining in-situ during revision surgery.

Tribocorrosion of sleeve and stem surfaces was evaluated on a four-point qualitative scoring system. Mild to moderate tribocorrosion (score 2-3) was observed on 92% of internal sleeve surfaces in contact with the stems, on 19% of external surfaces in contact with ceramic heads, and on 78% of the stem tapers. A negligible score of 1 was observed on 8% of the internal, on 81% of the external sleeve surfaces, and on 17% of the stem tapers. Severe fretting corrosion (score 4) was observed only on one stem taper, which had remained in situ during a previous revision surgery.

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## Fretting corrosion: an issue for BIOLOX®OPTION?



Predominantly negligible to mild corrosion was found on the three metal surfaces of 37 retrievals with BIOLOX®OPTION sleeved femoral heads. All stems were made of titanium alloy.

# Executive Summary

Issue 7 / 2017



<b>Title</b>	<b>Metal Artifact Reduction Sequence MRI Abnormalities in Asymptomatic Patients with a Ceramic-on-Polyethylene Total Hip Replacement</b>
<b>Authors</b>	J.M. Jennings, J.R. Martin, R.H. Kim, C.C. Yang, T.M. Miner, D.A. Dennis <i>Colorado Joint Replacement, Denver, Colorado, USA</i>
<b>Journal</b>	J Bone Joint Surg Am. 2017;99:593-8 d . <a href="http://dx.doi.org/10.2106/JBJS.16.00910">http://dx.doi.org/10.2106/JBJS.16.00910</a>
<b>Level of Evidence</b>	Level 4
<b>Summary</b>	<p><b>Jennings et al.</b> investigated the frequency and the type of fluid collections in 44 asymptomatic total hip arthroplasty (THA) patients with ceramic-on-highly crosslinked Polyethylene (CoXP; BIOLOX®<i>delta</i>, XP without antioxidant) bearings with a total of 50 hips. Only pain-free patients with at least 2-year follow up with appropriate positioned implant components (stem non-modular, no sleeves) and serial radiographs available within 2 years prior to study enrollment were included. MRI images were interpreted by one musculoskeletal radiologist and one arthroplasty surgeon.</p> <p>Mean follow up was 3.4 years. The mean Harris Hip Score of the patients was 98.5. Of the 50 hips, 9 showed fluid collections visible on the MRI scan and 5 hips intracapsular synovitis with a mean synovial thickness of 5.1 mm. Two of those hips were considered to have a thickened synovium (&gt; 6 mm). Further 4 hips showed extra-articular fluid collection with intracapsular communication with a mean synovial thickness of 6 mm. Two of those were considered to have a thickened synovium. In the whole cohort of patients with fluid filled collections no tissue destructions or solid lesions were found. Radiographic findings did not indicate implant loosening or other signs of adverse local tissue reactions (ALTR) in any of the patients. In 3 hips there were signs for potential early osteolysis. However, subtle osteolysis may be difficult to interpret on MRI. The identified osteolytic lesions may also have been subclinical preoperative lesions, which could not be identified with preoperative radiographs.</p> <p>The authors conclude that fluid collections are not uncommon in asymptomatic patients with well-functioning CoXP bearings and are likely benign without clinical consequence at least at short-term follow-up. Nevertheless, the patients should be monitored closely in case these fluid collections progress from benign to symptomatic or destructive lesions.</p>

# Executive Summary

Issue 7 / 2017



<b>Study Limitations</b>	Patient number was low and sample size based on power analysis
	Components were from one manufacturer
	Only radiographs available pre-operative for comparison - no MRIs
	Subtle osteolysis may be difficult to interpret on MRI. Osteolytic lesions in this study may have been subclinical preoperative lesions
	Material from fluid collections were not aspirated and histologically examined
	Study only short-term
<b>Key Messages</b>	<b>Fluid collections are not uncommon in asymptomatic patients with well-functioning CoXP bearings</b>
	<b>Fluid collection in CoP are likely benign and without clinical importance</b>
	<b>Patients should be monitored for progress of fluid collections</b>
<b>Commentary</b>	This study has been conducted in context with ALTR in MoM or MoP bearings. The aim of this study was to investigate the presence of tissue abnormalities in CoP bearings as a comparison and in order to investigate the prevalence of tissue abnormalities with limited corrosion or metal particles by using ceramic heads. MoM and MoP bearings can be asymptomatic nevertheless, tissue destruction can be severe (e.g. <b>Lash et al.</b> 2016).

# Executive Summary

Issue 7 / 2017



<b>Title</b>	<b>Fretting and Corrosion Damage in Taper Adapter Sleeve for Ceramic Heads: a Retrieval Study</b>
<b>Authors</b>	D.W MacDonald, A.F. Chen, G.C. Lee, G.R. Klein, M.A. Mont, S.M. Kurtz, H. Cates, M., Kraay, C.M. Rimnac <i>Philadelphia, Paramus, Cleveland, Knoxville, USA</i>
<b>Journal</b>	The Journal of Arthroplasty 2017. Article in press <a href="http://dx.doi.org/10.1016/j.arth.2017.04.025">http://dx.doi.org/10.1016/j.arth.2017.04.025</a>
<b>Level of Evidence</b>	Level IV (Case series)
<b>Summary</b>	<p><b>MacDonald et al.</b> conducted a retrieval study of 37 sleeved (Ti-alloy) ceramic heads (BIOLOX®OPTION). The implants were predominantly revised for instability, infection, or loosening. Implantation time was between 0 and 3.3 years. Seventeen sleeved heads were implanted during revision and 19 during primary total hip arthroplasty (THA). There were no revisions due to reactions to metal debris. All femoral stems have been made of Ti-alloy and were only revised if not well-fixed. A 4-point qualitative scoring system was used to evaluate tribo-corrosion of the sleeve and stem surfaces.</p> <p>Mild to moderate tribo-corrosion (score 2-3) was observed on 92% of internal sleeve surfaces (in contact with stems), 19% of external sleeves (in contact with ceramic heads), and 78% of stems. A negligible score of 1 was observed on 8% of the internal sleeve surfaces, 81% of external sleeves, and 17% of stems. No differences between sleeves used for primary or revision surgery could be detected. Severe fretting corrosion (score 4) was observed only on one stem taper, which has been retained in situ during a previous revision surgery.</p> <p>The severity of tribo-corrosion on the external sleeve taper was correlated with the implantation time and sleeve length correlated with the internal sleeve surface damage. No correlation between tapers surface condition and patient or implant factors was observed.</p> <p>The authors concluded that tribo-corrosion can also occur with sleeved ceramic femoral heads, but predominantly was only mild and lower than reported previously for metal-on-polyethylene bearings. They did not find a difference between the uses of sleeved ceramic heads for primary and revision surgeries. According to them sleeves are a reasonable solution for restoring the stem taper during revision surgery.</p>
<b>Study Limitations</b>	Short implantation time
	Sample size was low and not based on power analysis
	Retrieval study represent only failed implants
	No determination of material loss
	Only Ti-alloy stems were available
<b>Key Messages</b>	<b>On 81% of external adapter taper surfaces (in contact with ceramic) only negligible and the rest mild to moderate tribo-corrosion</b>
	<b>On 92% of internal sleeve taper surfaces (in contact with stem tapers) only mild to moderate corrosion scores</b>
	<b>No difference in tribo-corrosion severity between primary and revision applications</b>
	<b>The authors support the use of sleeved ceramic heads for revision surgery</b>
<b>Commentary</b>	This is another study on tribo-corrosion of retrievals showing limited corrosion at the sleeve-ceramic and only mild to moderate corrosion at the stem-sleeve interface for the BIOLOX®OPTION solution. Although only observed at a short follow-up period and taking into consideration other options in a revision situation this solution seems to be a reasonable and effective choice to address the tribo-corrosion issue.

# CONGRESS REPORT

Issue 7 / 2017



## 18<sup>th</sup> EFORT Congress – 2017

EFORT is the largest platform in European Orthopaedics to exchange knowledge and experience. The theme of the 18<sup>th</sup> EFORT congress was “Sports Activities and Orthopaedic Practice”. It was held from May 31 to June 2 in Vienna, Austria. The scientific program focused on symposia and instructional lectures given by distinguished speakers from Europe, as well as 3’116 presentations from all over the world in several parallel sessions; on the podium or as poster. The highlights of the congress included, among many others, e-health applications in orthopaedic research, hip trauma and sports, sports injuries of the shoulder, treatment of chronic bone infection, management of shoulder instability and functional outcome after unicondylar and total knee arthroplasty. 1’945 presentations dealt with orthopaedics, 533 of these with hip and pelvis-related topics. Interestingly and in contrast to this year’s AAOS Meeting, only four were on health economics.

This short report focuses bearings in THA.

### Periprosthetic Joint Infection

Once again, this topic was discussed from many angles: diagnostics and treatment, methods of potential, pros and cons of single and dual-stage revision. In a presentation based on 68’504 THA from the Danish Hip Registry, the authors found that revision for PJI is associated with a 2.18 times higher mortality risk than in the first year following revision surgery. A team from the Charité University Hospital in Berlin updated their report on differences in the presence of biofilm on various material surfaces in a large prospective multicenter study of retrievals.

➤ <http://efortnet.conference2web.com/#!resources/differences-of-biofilm-formation-on-ceramic-metal-and-polyethylene-bearing-components-on-hip-prosthetic-components>

They found significantly less biofilm mass on retrieved ceramic surfaces (34%), compared to polyethylene (98%) and metal surfaces (66%), potentially reflecting special characteristics of ceramics that seems to resist bacterial adhesion. This result was supported by research from the Australian Joint Replacement Registry, analyzing a database of 177’237 primary THA procedures over a 14-year period.

➤ <http://efortnet.conference2web.com/#!resources/ceramic-bearings-for-total-hip-arthroplasty-are-associated-with-a-reduced-risk-of-revision-for-infection-an-assessment-of-177-237-procedures-from-the-australian-orthopaedic-association-national-joint-replacement-registry>

The authors concluded that the use of a metal-on-polyethylene (MoP) bearing is associated with a significantly higher risk of revision for PJI compared to ceramic-on-ceramic bearings (CoC; hazard ratio 1.42) in patients younger than 70 years when cementless femoral components were used.

### Bearings

Several presentations, especially from various registries, tried to identify the “ideal” implant type in terms of the influence of fixation and bearing on survival and outcome. Due to the complexity and the cross-dependence of the various confounding factors, no definitive statement was made except on metal-on-metal (MoM). Partial segmentation of big data showed some differences (e.g. cemented vs. cementless, larger vs. smaller heads), but these diverged between registries. **Varnum et al.**, for example, analyzed the Danish Hip Registry and found that after adjusting for several patient- and surgery-related confounders, the revision risk for CoC was reduced by 4% and for CoP by 16% compared to MoP after 8.7 years of follow-up. Two other presentations by **Varnum et al.** were based on a questionnaire to determine patient reported outcomes for various bearing types with respect to satisfaction and noise. They found no significant difference in satisfaction scores between patients with CoC, MoM and MoP but noticed significantly lower satisfaction scores for all types of bearings and subscales when comparing noisy to silent THA.

*continued on page 2*

# CONGRESS REPORT

Issue 7 / 2017



## Polyethylene Bearings

**Bragdon et al.** presented a multicenter follow-up study of 377 THA with highly crosslinked PE (XPE), now at a minimum of 13 years, showing continuous negligible wear. Nevertheless, they detected a prevalence of 25.6% of radiographic lucency with metal heads of 26–32mm diameters. A similar result was shown in another presentation from the same group for larger heads.

**Takada et al.** presented results of their analysis of the differences in linear wear rate and osteolysis after THA between first- and second-generation XPE at a minimum of 5 years follow-up. Generally, they confirmed a low incidence of osteolysis and low linear wear of both specimens. Nevertheless, the wear rate of second-generation XPE was lower. A Japanese group detected oxidation in the weight-bearing area of XPE explants despite stabilization of the polymer. A German research group analyzed 75 total hip arthroplasties (THA) at a mean follow-up of 9 years and found that the wear rate of XPE was significantly higher in male patients than in females and also with larger compared to smaller femoral heads. They noticed an increase in wear rate after 104 months, which they found alarming.

## Metal Bearings

In contrast to other and especially non-European congresses, MoM was still discussed intensively in several sessions and presentations. An analysis of 144'438 THA patients in the Australian registry revealed an overall cancer rate of 7.6%. The rate was 6.3% with MoM THA, 8.9% for MoP, 7% for CoP and 5.9% for CoC.

Generally, metal ion release, especially Co and Cr, was presented and discussed in several presentations. A vigilant follow-up for MoM patients was recommended, even if the ion level in the patient's blood seems to be stable or decreasing after 5 years post-op. A presentation by a UK group demonstrated that patients with taper failure and lower blood ion concentrations appear to be at greater risk of developing ALVAL than patients with higher concentrations generated by excessive bearing surface wear. A multi-national research group also concluded that patients with larger components and bilateral surgery might be at increased risk for adverse local soft tissue reactions related to corrosion.

## Ceramic Bearings

**García-Rey et al.** presented their results on 120 fourth-generation CoC in very young and active patients at 5–17 years follow-up. The survival rate was higher than 92% at a mean follow-up of 10.4 years. They concluded that uncemented CoC THA is an excellent option for young and very young patients.

**Rollier et al.** reported on a single product multi-center outcome study of 469 patients with fourth-generation CoC with a mean follow-up of 6.3 years. Apart from standard complications, they observed 2 liner fractures (1 post-op, 1 after trauma). They did not detect any granuloma, loosening or wear. The real squeaking rate was low (0.6%) and did not affect patient satisfaction, functional result or survivorship (97%).

**Leithner et al.** reported results of a single-center, single-design CoC series with 870 CoC bearings and a minimum follow-up of 10 years. With this design, inlay fracture occurred in 0.2%, which they associated with component malposition. A noisy or squeaking hip was observed in 2.3% of the cases. Survivorship was 99.3% at 10 years.

**Dhawan et al.** presented their prospective study data on 43 patients with fourth-generation CoC THA at 10 years follow-up. No fractures were reported. 4.7% experienced a squeak in deep flexion, which did not affect quality of life. Survivorship at 10 years was 99.9%, showing superior results compared to third generation ceramics.

**Marin-Peña et al.** reported on a prospective study of 65 THA with fourth-generation CoC bearings at a mean follow-up of 4.2 years. They detected no dislocation or infection. One ceramic-liner fractured and was revised to another CoC bearing. There were two patients with squeaking less than once a month not requiring revision. Overall, the authors noticed a low rate of complications in their active and young patients. **Sununu** investigated a single-center series of 1'866 THA with fourth-generation CoC bearings. No case of ceramic fracture or squeaking was observed. At a minimum follow-up of 5 years, survivorship was 97.9%.

## Varia

**Trieb** presented his results with a metal-free ceramic total knee arthroplasty compared with a geometrically identical metallic one in 40 patients, both after one-year. He found no significant differences, neither clinically nor radiologically in the short term, therefore suggesting a ceramic knee system as a suitable option for patients with a known hypersensitivity to metal.

# CONGRESS REPORT

Issue 7 / 2017



## References

### PJI

**Differences Of Biofilm Formation On Ceramic, Metal And Polyethylene Bearing Components On Hip Prosthetic Components**  
*Andrej Trampuz, Katsiaryna Yermak, Nora Renz*

**Ceramic Bearings For Total Hip Arthroplasty Are Associated With A Reduced Risk Of Revision For Infection – An Assessment Of 177,237 Procedures From The Australian Orthopaedic Association National Joint Replacement Registry.**  
*Rami Madanat, Stephen Graves, Michelle Lorimer, Orhun Muratoglu, Henrik Malchau*

**Increased Mortality Following Prosthetic Joint Infection In Primary Total Hip Arthroplasty**  
*Claus Varnum, Alma B. Pedersen, Per Kjærsgaard-Andersen, Søren Overgaard*

### Bearings

**How can registries advise us on which bearings to choose?**  
*Ashley Blom*

**Effect of THA bearings and outcome**  
*Claus Varnum, Alma B. Pedersen, Per Kjærsgaard-Andersen, Søren Overgaard*

**Frequency Of Noises And Their Influence On Patient-Reported Outcome In Total Hip Arthroplasty**  
*Claus Varnum, Alma B. Pedersen, Per Kjærsgaard-Andersen, Søren Overgaard*

**Is Patient-Reported Outcome After Total Hip Arthroplasty Influenced By Type Of Bearings?**  
*Claus Varnum, Alma B. Pedersen, Per Kjærsgaard-Andersen, Søren Overgaard*

### Ceramic

**Ceramic-On-Ceramic Total Hip Replacement In Young And Very Young Patients. A 5-to 17-Years Comparative Follow-Up Study**  
*Eduardo Garcia-Rey, Eduardo Garcia-Cimbrelo*

**Uncemented Total Hip Replacement Using Ceramic-On-Ceramic Bearing 469 Patients Cross-Sectional Multicentric Retrospective Study With More Than 4 Years Follow Up. Results, Complications, And Squeaking Study**  
*Jean-Charles Rollier, Laurent Jacquot, Michel Henry Fessy, Jean-Christophe Chatelet*

**Up To 10-Years Follow-Up Of 870 THR With Ceramic-On-Ceramic Bearing: A Retrospective Single Centre Study**  
*Werner Maurer-Ertl, Jörg Friesenbichler, Michael Maier, Gerhard Bratschitsch, Lukas Holzer, Andreas Leithner*

**Minimum 10-Years Results Of Alumina Matrix Composite Ceramic-On- Ceramic Uncemented Total Hip Replacements**  
*Rohit Dhawan, John-Paul Whittaker, P Gregson, NM Graham, SL Karlakki*

**5-Years Single Centre Experience With 1,866 Total Hip Replacements Using 4th Generation Ceramic-On-Ceramic Bearings**  
*Tarek Sununu*

**3077 - Short-Term Complication Rate With Ceramic-On-Ceramic 36mm Head**  
*Oliver Marin-Peña, Javier Montoya Adarraga, Fernando Oñorbe, Mohamed Abd El-Radi, Supreeth Nekkanti, Ricardo Larrainzar Garijo*

**Survival of THA with CoC bearings**  
*Claus Varnum, Alma B. Pedersen, Per Kjærsgaard-Andersen, Søren Overgaard*

### PE

**Minimum 13-Years Multi-Centre Evaluation Of Total Hip Arthroplasty With Highly Cross-Linked Polyethylene Liners And Standard Diameter Femoral Heads**  
*Charles Bragdon, Christopher Barr, Christian Skovgaard, Daniel Berry, Craig Della Valle, Kevin Garvin, John Clohisy, Ayumi Kaneuji*

**Minimum 10-Years Multi-Centre Evaluation Of Total Hip Arthroplasty With Highly Cross-Linked Polyethylene Liners And Large Diameter Femoral Heads**  
*Charles Bragdon, Christopher Barr, Christian Skovgaard, Daniel Berry, Craig Della Valle, Kevin Garvin, Per-Erik Johanson, John Clohisy*

**Comparison Of Wear Rate And Osteolysis Between Second-Generation Annealed And First-Generation Remelted Highly Cross-Linked Polyethylene In Total Hip Arthroplasty**  
*Ryohei Takada, Tetsuya Jinno, Kazumasa Miyatake, Takeshi Muneta, Atsushi Okawa*

**XLPE-Liners Show Similar Wear To UHMWPE Liners In THA After 9 Years Of Follow-Up**  
*Constantin Mayer, Moritz Rommelmann, Bernd Bittersohl, Michael Behringer, Marcus Jäger, Rüdiger Krauspe, Christoph Zilkens*

**Wear And Oxidation In Highly Cross-Linked Melted Polyethylene Liners Retrieved At A Minimum Of 11 Years After Total Hip Arthroplasty**  
*Takuya Nakamura, Yoshinobu Maruhashi, Noriyuki Hashimoto, Kenichi Ueshima, Takeshi Sasagawa, Kiyonobu Funaki*

### MoM

**Are Metal-On-Metal Prostheses Associated With An Increased Risk Of Cancer? A Nationwide Cohort Study**  
*Stephen Graves, Nicole Pratt, Yuanyuan Wang, David Wood, Flavia Cicuttini, Peter Lewis*

**The Clinical Implications Of Metal Debris Release From The Taper Junctions And Bearing Surfaces Of Metal-On-Metal Hip Arthroplasty. The Aseptic Lymphocytic Vasculitis Associated Lesion (ALVAL) Response And Soft-Tissue Injury**  
*Raghavendra Sidaginamale, Jonathan O'Hare, Antoni Nargol, Thomas Joyce, Sonali Natu, David Langton*

**Predictive Factors On Metal-Ion Levels In Metal-On-Metal Total Hip Arthroplasty**  
*Maximilian Kasperek, Lisa Renner, Martin Faschingbauer, Wenzel Waldstein, Michael Weber, Friedrich Boettner*

### Varia

**Prospective Comparison Of A Metal-Free Ceramic Total Knee Arthroplasty With An Identical Metal System**  
*Klemens Trieb*