This year’s annual ORS Meeting was attended by over 3'500 researchers, MDs and scientists from academia, health authorities and industry. More than 2'400 papers and posters were presented in several parallel sessions during the three days. Most of the presentations were covering basic research and biologically oriented topics, focusing on bone, cartilage and cell behavior. A smaller number of presentations dealt with applied research on arthroplasty and/or clinical outcomes. This report focuses on highlights in the field of total hip arthroplasty (THA) bearings and related topics.

Contact mechanics, edge loading
Several papers dealt with edge/rim loading in THA, especially in hard-on-hard bearings but also in hard-on-soft metal/ceramic-on-polyethylene (M/CoPE) articulation. Hip joint kinematics were measured using different methods and were applied to determine a safe zone for edge loading. The inter-patient hip joint reaction force-loading vector and hip kinematics do not appear to have a large effect on the degree of rim loading although a relatively high variation due to variations in THA prosthesis alignment has been noticed. A stereo-radiographic investigation of THA patients performing five dynamic activities identified load-free positions where sliding and possible separation between the articulation couples occurred that ranged on average from 1.5 to 2.6mm. In a separate simulator study, this amount of separation was shown to increase the PE wear rate significantly compared to nominal test conditions. The authors recommended that testing for adverse wear conditions, including separation, must be conducted in order to challenge current and new THA devices and to understand the possible clinical implications of any adverse event.

Corrosion
This issue was a major topic again. Two papers presented catastrophic material loss from tapers and even dissociation of the head-taper connection.

Some presentations were based on retrieval analyses, aiming to estimate cause and parameters of corrosion and the failure of hip implants due to this phenomenon. Several suggestions how to reduce the incidence and impact of tribocorrosion were made, including electrochemically generated tribolayers, coatings or surface hardening for modular connections. An intermediate polymer sleeve had also been tested for this purpose. Generally, it was confirmed that material loss of the CoCr heads increases with time in situ. Some papers showed efforts to predict corrosion in laboratory settings that would allow for parametric testing and optimized development of design and material. A group from Rush University, Chicago, USA, presented a patient-driven SMART biosensor that will allow for routine home check-ups for metal ion level in the body – very similar to a glucometer for diabetic patients. Metal-on-metal (MoM), the effects of tribocorrosion and CoCr wear were still discussed, although to a lesser extent than in previous years as MoM has become a niche product. Nevertheless, metal-ion analysis and MRI were recommended even in the absence of symptoms.

Another team from Rush University confirmed the observation previously made on cell-induced corrosion. They also found that the amount of Co was considerably reduced in Co-alloy particles from a failed THA trunnion, demonstrating the solubility of this potentially cancerogenic* metal.

* see Monthly CeraNews, 12 / 2016

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Corrosion (continued from page 1)
Several papers showed a correlation of the axial-seating load magnitude of the modular head (1–8kN), micro-motion and subsequently tribocorrosion of the stem. Large tapers (12/14 plus) seem to be more sensitive to the impaction force applied by surgeons than small tapers (10/12). However, less variation was found in micro-motion across all impaction force groups, and micro-motion along that taper axis decreased with larger impaction forces. This implies that increasing impaction force may increase the stability of the head-neck junction and this does not seem to depend on the topography of the stem. A well-assembled modular connection is only affected minimally by stem offset, applied load or head offset. Seating angles up to 20° away from the neck axis lowered the load necessary to initiate fretting corrosion. In case of revision, cleaning a corroded taper, even using only wetted surgical gauze pads, can reduce any surface deviation and taper angle almost to the pristine situation without affecting the pull-off strength.

A couple of presentations demonstrated that cobalt release also occurs in total knee arthroplasty (TKA), especially in abrasive wear situations, reaching an amount similar to MoM in THA. One study showed a rapid increase in CoCr loss by abrasive wear in TKA and concluded that adverse reaction to metal debris is an increasing concern to orthopaedic surgeons, possibly having profound implications for the chronically painful knee. Another presentation showed data supporting the finding that patients with painful TKA exhibit increasing Co levels and incidence of in-vitro metal reactivity. This suggests that patients with aseptic painful TKA and a history of metal allergy may be likely to have pain associated with metal sensitization.

Polyethylene
Howie et al. (Australia) reviewed 100 hips using CT to identify prevalence and volume of osteolysis in both 28mm and 36mm metal-on-highly crosslinked PE (MoXPE) articulations. They identified radiolucent lesions in 40.8% of these patients, even in the absence of significant XPE wear. The prevalence of osteolytic lesions in THA with a 28mm articulation was 34%, compared to 47% of those with a 36mm articulation (p=0.08). Overall, the mean wear rate was 0.04mm/year with no significant difference between 28mm and 36mm articulations (p=0.48). The authors stated that previous reports might have underestimated the prevalence of osteolysis due to poor imaging and small patient cohorts. They also identified a greater total volume of osteolysis in patients at longer-term follow-up and stated that the relatively high prevalence of osteolysis in the absence of XPE wear is of significant concern for the long-term survival of the components.

Muratoğlu et al. (Boston, USA) reported about a drug eluting XPE. They showed the efficacy of a layered, drug eluting PE construct developed for a fully articulating joint prosthesis for the treatment of periprosthetic infections. A lapine knee infected with an S. Aureus biofilm was treated with this antibiotic-eluting PE, resulting in complete bacterial eradication without any detectable systemic side effect. The authors concluded that this material is a candidate for a full-load bearing joint implant that can deliver the type and concentration of drugs required to eliminate a biofilm infection, and that it has the potential of curing PJI with a single-stage revision surgery.

Several presentations compared several types of commercially available highly crosslinked XPE with a focus on historical varieties versus Vitamin E-stabilized types (VXPE). The results showed that all investigated XPE exhibited essentially similar mechanical and oxidation properties. A number of independent studies investigated the ageing and accelerating ageing effect of VXPE. They showed no negative effect on its properties in sophisticated test set-ups. A large clinical study from Japan showed no differences in clinical and wear results at a minimum follow-up of 2 years.

Two papers presented first in-vitro results with a thin XPE used as surface replacement. A hip simulator study showed that although the femoral head size has influence on the wear rate of CPE and XPE liners, the liner’s thickness does not.

Dual Mobility bearings
There were only few presentations on this type of THA bearing. It had experienced a renaissance some years ago by addressing the risk of instability, a major cause of revision. Generally, for patients with a high dislocation risk, this option reduces the incidence of dislocation and shows equivalent or better wear properties compared to fixed hip bearings.

References available at CeramTec GmbH