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STIMULI FROM ORTHOPAEDICS AND THE PROFESSIONAL FIELD – FOR PHYSICIANS, SPECIALISTS AND EXECUTIVES

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In-vitro wear reduction in Total Shoulder Arthroplasty

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Improved materials can contribute to preventing PE-induced osteolysis and aseptic implant loosening. Ceramic heads and vitamys glenoids show significantly reduced wear even under extreme in vitro conditions. [1]

The glenoid remains the weak link in shoulder arthroplasty with various modes of glenoid component failure still problematic. Wear of the polyethylene glenoid component and subsequent particle-induced osteolysis is one of these modes of failure similar to that observed in hip and knee arthroplasty.

The kinematics of a shoulder arthroplasty are more similar to a knee than a hip in that the articulation is noncongruent with resultant relative point-loading. There is a combination of rolling and sliding motions, which result in a systematic edge loading scenario.

In hip replacement surgery with congruent articulation, the degree of polyethylene cross-linking is regarded as the main factor in reducing PE wear. In shoulder arthroplasty, maintenance of PE elasticity by stabilisation with vitamin E, especially in the edge-loading scenario, can contribute to further improvement of wear behaviour.

VE-XPE versus UHMWPE in the shoulder simulation model

A recently published study was performed to assess the in vitro performance of vitamin E enhanced, highly cross-linked polyethylene (VE-XPE, vitamys) compared with conventional ultra-high molecular weight polyethylene (UHMWPE) in a shoulder simulation model. [1] Both unaged and artificially aged components were tested to investigate the effect of vitamin E on oxidative degradation and elasticity of polyethylene over simulated lifetime.

The four test series are summarized in Table 1. All components are commercially available shoulder prostheses manufactured by Mathys Ltd Bettlach (Switzerland).

The glenoid components of series TS2 and TS4 were artificially aged before the wear test. The accelerated aging simulates shelf life or *in vivo* conditions equivalent to approx. 10 years.

The wear tests were performed in shoulder joint simulator at an independent laboratory (IMA Material Research and Application Technology GmbH, Dresden, Germany).

The simulation completed 500 000 cycles of simulated arm motion incorporating angular movement around both the x- and y-axis. The movement around the x-axis and the y-axis is simulating adduction-abduction and arm forward flexion-extension.

Additional translational movement along the y-axis was initiated (with guided edge loading ± 1.5 mm initiated by a horizontal actuator) to simulate rolling, sliding, and cross-shear mech-

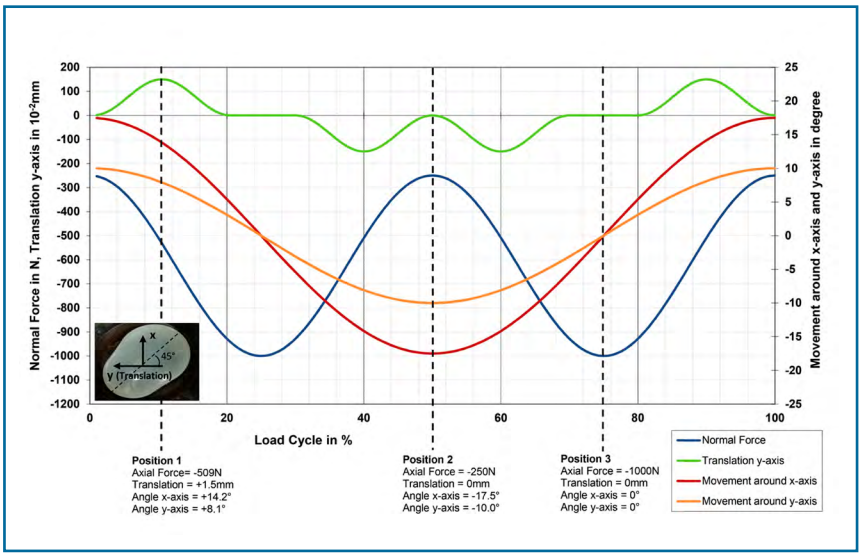
Table 1 *Overview of the four test series*

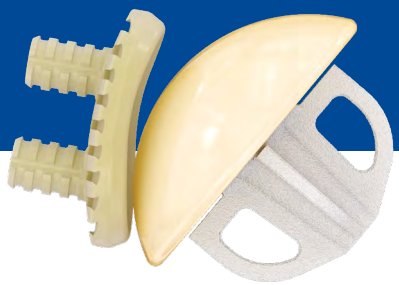
Table I Summary of the four test series

Test series	Component	Material
TS1	Glenoid	UHMWPE
	Humeral head	Ceramic (Al_2O_3)
TS2	Glenoid	UHMWPE (aged)
	Humeral head	Ceramic (Al_2O_3)
TS3	Glenoid	VE-XPE
	Humeral head	Ceramic (Al_2O_3)
TS4	Glenoid	VE-XPE (aged)
	Humeral head	Ceramic (Al_2O_3)

UHMWPE, ultrahigh-molecular-weight polyethylene;
VE-XPE, vitamin E-enhanced highly cross-linked polyethylene.

Fig. 1 *Kinematic profile of the shoulder simulator demonstrating curves for load, angular movement, and displacement during a single cycle. The orientation of the glenoid component relative to the x- and y-axis is also demonstrated.*





anisms. The kinematic profile is demonstrated in Figure 1.

49 % less wear with vitamin E stabilised PE

On the articulating surfaces the transition between loaded and unloaded regions was clearly visible. Evidence of wear around the rim of the prosthesis confirmed that edge loading had occurred during the simulation. No backside wear was observed. Mean wear rates for the four test series are summarized in Figure 2.

Compared with matched unaged cohorts, both aged cohorts demonstrated increased wear rates after artificial aging; however, the advantage of vitamin E–stabilized specimens over conventional polyethylene is more pronounced with a 49 % reduction in wear in the vitamys group (P = 0.0002).

These findings suggest that, relative to conventional polyethylene, vitamin E stabilised polyethylene has superior wear characteristics both a) at the time of implantation, and b) also long term as this advantage may persist or even be exaggerated because of resistance to in vivo oxidative degradation.

The introduction of a second innovation (ceramic head) in addition to the studied variable (VE-XPE) may be considered a limitation of this study. It is important to consider, however, that the ceramic humeral head component was consistent across all test cohorts and therefore will not affect comparisons between the groups. The use of ceramic heads is supported by the findings of Mueller et al [2]. This study demonstrated a 27 % reduction in wear rate using a ceramic head compared with a metallic head in a shoulder simulator model.

Given the reduced volume of wear particles with these innovative head and glenoid materials, reduced osteolysis can be expected resulting in improved implant longevity.

References

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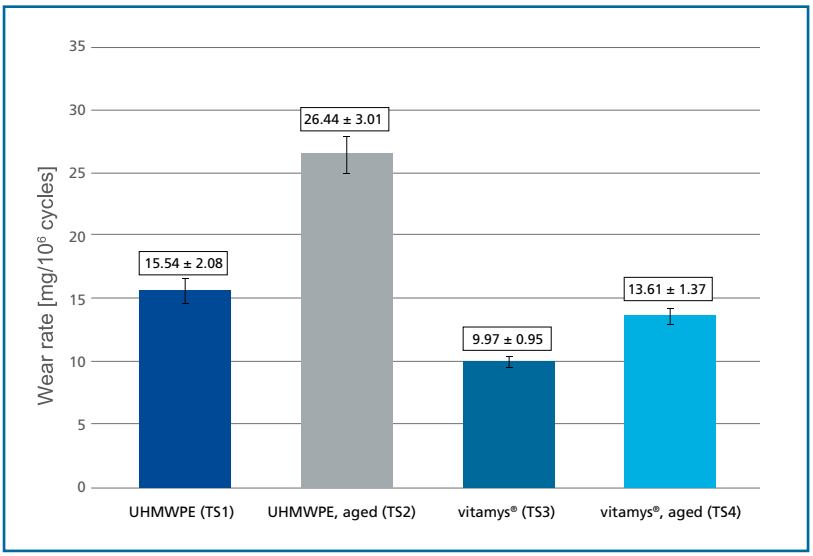
Fig. 2 *Gravimetric wear results for the four test series.*



balanSys BICONDYLAR – It's a PLUS
The knee system with added value

Twenty years of clinical experience and exceptionally low revision rates speak volumes for the balanSys BICONDYLAR [1] – today more than ever! This knee system features clinical reliability with a survival rate of 97.0 % after 12.4 years and scores highly in terms of patient satisfaction. [1]

Building on its proven implant design, Mathys is constantly refining the balanSys BICONDYLAR while highlighting the continual improvement of this knee system in the process. Expectations in terms of stability, precision, enhanced technology and longevity are brought together and continued in balanSys BICONDYLAR PLUS.

This proven prosthesis now comes with additional PLUS points to guarantee the surgeon real added value in the operating theatre:

PLUS leggera instruments

The name «leggera» comes from the Italian word meaning «light». Leggera instruments simplify the procedures involved in implanting the balanSys BICONDYLAR prostheses and are based on the principles of intuitiveness, efficiency and clarity.

PLUS vitamys inlays

This vitamin E-enhanced, highly cross-linked polyethylene is designed to deliver maximum resilience and a long service life. Properties such as high resistance to oxidation, excellent ageing resistance, high wear resistance and good mechanical properties are the hallmarks of vitamys and guarantee the long-term preservation of the endoprosthesis, even in active patients. [2]

PLUS refined height increments of vitamys inlays

Precise balancing settings for the flexion and extension gaps help surgeons establish natural ligament tension. The result? Superb stability over the entire range of movement. With refined height increments, the surgeon gains intra-operative flexibility and can fine-tune stability with just a few actions before the operation is over.

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www.balanSys.com

Preservation in motion

Learning from top surgeons

Medical students, doctors, operating theatre personnel and other interested parties worldwide can now – at least virtually – follow the work of top surgeons as though they were there in the operating room in person.

This is the promise of the maker of the GIBLIB VR app which, with its technology, perfectly emulates a complete operating theatre environment with 360-degree Virtual Reality content with filmed and live-stream operations. Procedures are filmed using cameras that follow the surgeon's line of sight and offer a 360-degree view of the operating room. The teaching videos are produced exclusively in cooperation with leading hospitals such as the Cedars-Sinai Medical Center and the Keck School of Medicine of the University of Southern California. To access to GIBLIB's media collection, a subscription along with an Oculus Go headset or Oculus Rift system are required. The app to go with this is available from the Oculus store.

Further information about the GIBLIB streaming media platform and how you can download the app can be found at www.giblib.com.

Generation Z – gamer or game-changer?

It's not just the letter that sets Generation Z apart from its predecessors. With their values and desires, the 15- to 25-year-olds starting their professional careers now, will present major challenges to hospitals as employers.

Christian Scholz, author of the book entitled «Generation Z» [1] and Professor Emeritus and researcher in the field of employment at the University of the Saarland, advises companies to look hard at the value patterns of Gen Zers. A better understanding of their differences and similarities can, after all, provide a major advantage in the competition to recruit the best talent from this young generation.

Gen Zers play, learn and live digitally

Scholz believes that the «Digital Natives 2.0» have different ambitions to Generation Y (those born between 1980 and 1995, see *move!* 77, 2015), for whom the Internet and e-mail were still new. Generation Z grew up with a controller in its hands and a fast Internet connection – they're gamers who play, learn and live digitally. This is why the future generation of healthcare professionals expects state-of-the-art technologies in its training and patient care. [2] Smartboards, digital patient folders, online rotas and employee apps will quicken the pulses of Gen Zers. [3] Student nurses and Physiotherapy students also want to be taught «off-site», outside the hospital. Think about the use of podcasts, websites and interactive tutorials. Virtual patient simulators and serious games provide an opportunity to practice certain medical scenarios, such as emergencies, without endangering patients. [4] For many hospitals, this can represent a 180-degree change compared to traditional learning and communication methods. It is a journey that can pay dividends, however, since Generation Z brings innovative thinking and inquisitive minds to the hospital. [2]

Winning with technologisation

In a recent study, more than 12 000 students in 17 countries were asked about their expectations for the future and about technology in the workplace. [5] Two-thirds of those surveyed from Brazil, China, Indonesia, the Philippines, Thailand, Turkey and Vietnam stated that technical facilities would be a criterion for them when choosing a workplace. [5] For young people from affluent industrial nations, the technology factor appears to play a less important role: for a good third (36–37 %) of those surveyed from Germany, Australia, New Zealand and the USA, the technology offered by a potential employer would be a factor if they had to choose between several similar job offers. [5] Gen Zers find out about hospitals as potential employers through social networks and on ratings portals. Hospitals should therefore involve Facebook, Twitter, Tumblr and so on in their recruitment activities.

Private lives take priority

Hospitals must accept the fact that, for the next generation of doctors, the balance of work and family takes priority, [6, 7] followed by job security [7] or standard working hours. [6] For Generation Z, work is more of a means to an end – ideally reduced to the period between 9 a. m. and 5 p. m., or at least to a regular 8-hour day. [1] The previous generation was still willing to work more if they were able to use the hours they had accrued for a longer holiday, for example. [3] Today, work-life separation is in demand – the strict separation of private lives and work. [1, 3] In orthopaedics and trauma surgery especially, this is a hard feat to accomplish. At least this is what many medical students believe, and therefore choose not to train in this discipline, according to a survey of more than 13 000 medical students. [8]

Always on the go

Generation Z regards working time as living time, time in which they want to feel good and realise their goals. [1] Especially attractive to Gen Zers are organisations that promote their employees' health, such as through fitness programmes, healthy canteen food and a stress-free working environment. [2] However their first job is just a springboard: [9] if something doesn't suit them, or if another hospital offers better

conditions, then they will simply walk. Lack of acknowledgement and career development opportunities are the main reasons for changing.[9] Therefore frequent feedback is important – ideally in a positive and specific form.

For hospitals as employers, the art lies on the one hand in making limits clear to Gen Zers, e.g. that patient well-being takes priority over leaving work on time, and on the other hand offering them «carrots», such as using virtual reality games in training. In the «war of talents», the key is to create an attractiveness advantage. That's because, in our agile, digital and globalised world, Generation Z employees are needed, says Prof. Scholz, referring to Generation Z as «game-changers» with ideas that will change the world of work.[10]

Our downloadable checklist will tell you what matters when dealing with Gen Zers.

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Download

The checklist of «Do's and don'ts when dealing with Generation Z» is available for you to download

Further reading

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