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A slick way to test artificial knees and hips

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A new study suggests that natural proteins can be used to effectively test new replacement hip and knee joints in the laboratory. The work could help with improving design in order to reduce wear and tear and increase the lifespan of such prosthetics. Details are reported this week in the *International Journal of Surface Science and Engineering*.

Belinda Pingguan-Murphy and Subir Ghosh of the University of Malaya, Malaysia, and Dipankar Choudhury of Brno University of Technology, Czech Republic, explain that albumin and globulin proteins are the predominant protein components of the synovial fluid which surrounds healthy joints. Albumin is also the main protein component of egg white and blood plasma. The proteins are also found within the fluid held around our joints by the synovial membrane. They play important roles in the lubrication mechanism of our joints.

The selection of materials for the prosthesis head and cup of a replacement joint relies on the mechanical and surface properties of the materials chosen and how well they take aboard the natural lubricating proteins. Advanced joints use ultra high molecular weight polyethylene (UHMWPE) because it is not only flexible but is also resistant to wear. UHMWPE also repels water, it is hydrophobic and this is usually coupled with a ceramic component which is the opposite, hydrophilic, and so makes a perfect sliding partner for least friction.

However, there is always room for improvement in terms of lowering friction and making a prosthetic joint move even more smoothly as well as in terms of extending the lifespan of a joint. Such improvements

would give patients a better quality of life as well as extending the time between prosthetic surgery, if a repeat procedure is even an option.

Pingguan-Murphy and colleagues point out that hip and knee replacements tend to fail at a rate of 10 to 12 percent within about ten to fifteen years. Given an aging population and increased life expectancy, such statistics will be an increasing burden on healthcare services and a problem for elderly patients themselves. The team has now investigated the frictional properties, the tribology, of albumin and globulin on ceramic-on-polyethylene hip joint implants.

"Our work seeks to better understand the use of natural lubricant selection in the in vitro [laboratory] testing of potential joints," explains Pingguan-Murphy. "Many joints which do well in tests fail in practice; and one of the reasons may be the failure to use these natural lubricants in testing, and so failure to mimic the actual tribology in vivo [in a patient]," she explains.

The data point to an improved approach to testing new designs, different materials and different surfaces for prostheses that function better with the body's natural joint lubricants.

More information: Subir Ghosh et al, Lubricating ability of albumin and globulin on artificial joint implants: a tribological perspective, *International Journal of Surface Science and Engineering* (2016). DOI: 10.1504/IJSURFSE.2016.076516

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