Design and fabrication of epoxy-based hip implants

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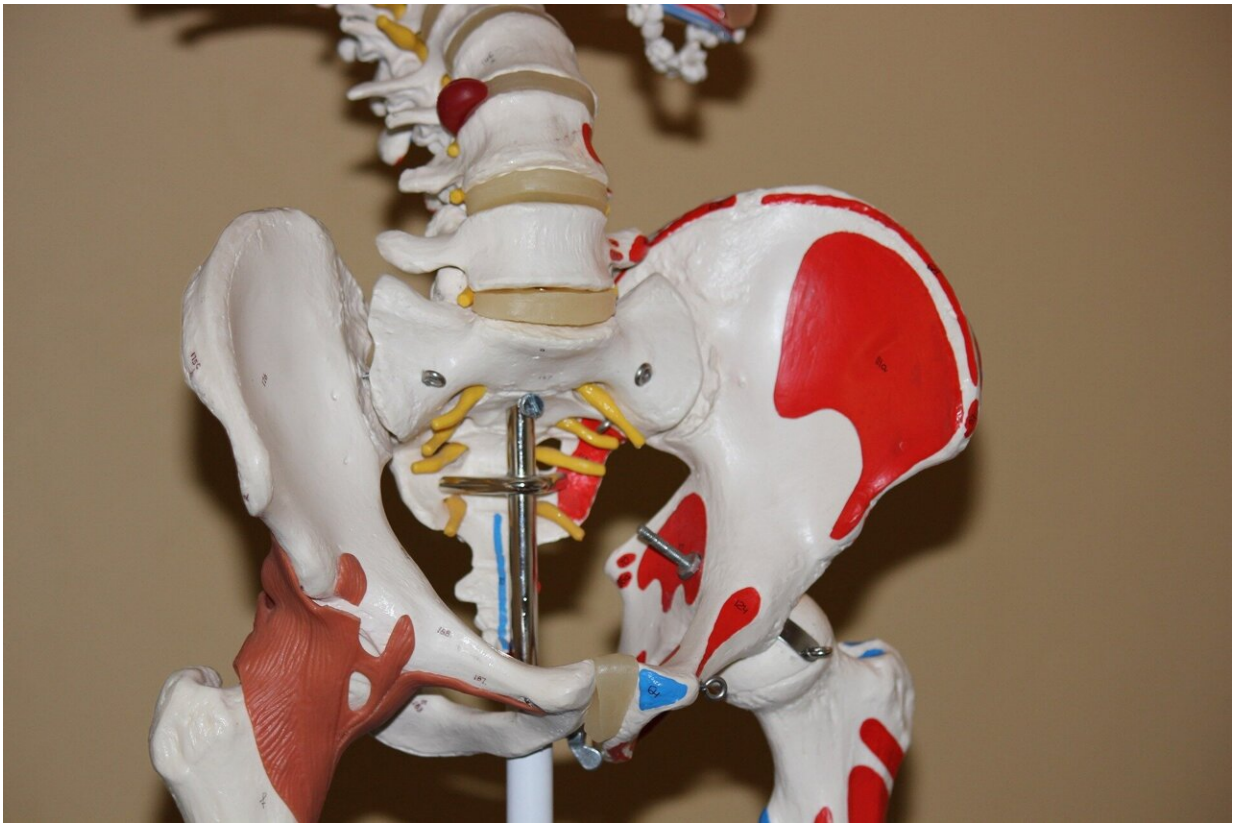

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Prosthetic joints are usually fabricated from medical-grade metals, such as titanium and ceramics. However, despite major advances in replacement hip bones made from such materials, there always remains

the issue of biocompatibility and ultimately corrosion caused by the physiological conditions surrounding the prosthetic. Corrosion leads to deterioration of the structure and loss of mechanical strength in the prosthetic. Ultimately, the replacement hip will itself need to be replaced with all the surgical and physical limitations that will entail.

Researchers writing in the *International Journal of Materials Engineering Innovation* discuss an alternative material for prosthetic hip joints—an epoxy resin, which is non-toxic, biocompatible, and strong.

Ranjit Singh, Manoj Narwariya, and S. Chauhan of the IPS College of Technology and Management in Gwalior, Avadesh K. Sharma and Rajeev Singh of Rajkiya Engineering College in Mainpuri, India, explain how they have used computer modeling to design an epoxy-based prosthetic hip joint and made a prototype using liquid epoxy and a newly developed 3D-printed mold.

Tests on the epoxy hip showed it to have the ability to cope with a maximum stress of 5.22 megapascals and to be weakest at the neck of the structure, based on use of a polariscope. Compression tests showed it to have very similar mechanical properties to human bone. The epoxy hip has a bone-like elastic modulus, yield strength, and compressive strength of 5.85 gigapascals, 70.63 megapascals, and 116.97 megapascals, respectively.

The nature of epoxy materials means that they are likely to be far more biocompatible and far less prone to corrosion in the body than a conventional prosthetic hip joint. The team adds that the use of epoxy materials rather than other types of polymer avoids the issue of lower mechanical strength seen with the likes of polylactic acid, poly(l-lactide), and poly(propylene fumarate).

More information: Rajeev Singh et al, Design and fabrication of

Epoxy-based Hip Implants, *International Journal of Materials Engineering Innovation* (2022). DOI: 10.1504/IJMATEI.2022.10047998