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Wear depth distribution of articulating surfaces of retrieved hip prosthesis using non-contact interferometer

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With an increasing demand for prosthesis hip implantation, there is an increasing need for a more sophisticated wear testing device which would simulate the geometrical parameters, kinematic motions, load profile and biological lubricating conditions across the articulating surfaces of pair of materials of hip implants. Investigations on wear mechanisms and quantifying the wear depth distribution in acetabular cups have been extensively undertaken by researchers over the last two decades using *in vitro* studies. While the load profile is well defined in ISO–14242 for a gait cycle, numerous investigations are performed using hip simulators and computational techniques to propose wear rate, wear tracks and wear depth distribution in acetabular cups. However, there is a need to understand wear depth distribution and wear tracks from *in vivo* studies to integrate kinematic motion and load profile across articulating surfaces of hip joint and design a wear mechanism for a wear screening device. In this work, retrieval study is carried out on a scanning white light interferometer using 20 retrieved acetabular cups from Indian patients and compared with wear depth distribution and wear tracks using hip simulators and computational techniques.

Maximum linear wear was observed to be in the supero-posterior region of the cup. New wear sliding track is extracted from the wear depth distribution using Archard's wear law and load profile in a gait cycle (as per ISO–14242). Procedure has been devised to plot the most dominant wear sliding track and a complete protocol of wear sliding tracks has been proposed to customize wear screening device (like ball-on-disc or pin-on-disc tribometer) in order to get results similar to the clinical study. Comparative results show that wear distribution and wear track is primarily dependent on the materials of the contact pair constituting the acetabular cup and the femur head, type of motion and load profile during human gait cycle over the functional life of the artificial hip joint.

Biography

Dhananjay M Kulkarni is a Professor of Mechanical Engineering Dept at BITS Pilani, K K Birla Goa Campus, India. He is also Dean Administration and Associate Dean, Faculty Affairs. He has his Masters from IIT Kharagpur and PhD from BITS Pilani. He has 18 years of teaching and 3 years of industrial experience. His research area is Biotribology and Fracture Mechanics. He has research grants from various industries and DST in the area of Bio-Tribology. He has published 40+ key papers in the international journal of repute and international conferences in India and abroad. He was a certified Instructor of American Society of Mechanical Engineering (ASME) to design the courses and train the industrial professionals in India.

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