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Total Shoulder Replacements Wear Tested In A Unique Shoulder Simulator

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Background
Loosening and failure of shoulder implants in vivo has been attributed to the wear of polymeric components [1,2]. The Newcastle Shoulder Wear Simulator [3,4] is the first multi-station programmable simulator capable of reproducing activities of daily living allowing in vitro comparison of shoulder implants.

Methods
The Simulator [3,4] was used to test six JRI Total VAIOS shoulder prostheses, five in wear stations and one in a control station. A 2 million cycle wear test was performed in diluted bovine serum (protein content 26 g/L) using gravimetric measurements to determine polymeric wear. ‘Mug to Mouth’ was selected as an activity of daily living. Loads applied ranged from 180N to 250N at 1 Hz. Motion ranges were -16° to +12° flexion-extension, -18° to -5° abduction-adduction, and -42° to -17° internal-external rotation with 4 mm of sliding motion. Polymeric wear debris was analyzed using a Nanosight LM10-HS [3].

Results
The mean wear rate of the five articulating polymeric components was 21.3 ± 4.5 mm³/10⁶cycles. Wear particles were sub-micron in size.

Conclusion
A previous wear test of JRI Reverse VAIOS Shoulders produced sub-micron particles at a wear rate of 14.2 ± 2.1 mm³/10⁶cycles [3]. The increase in wear can be attributed to the addition of sliding in the simulation. This is the first reported comparative wear test of Reverse and Total shoulder versions of the same design of implant.

Implications
Reverse shoulders may outperform Total shoulders clinically due to lower wear rates.

References