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RESEARCH ARTICLE

Surface wear in a custom manufactured temporomandibular joint prosthesis

Nikolas De Meurechy[1,2] | Merve Kübra Aktan[3] | Bart Boeckmans[4,5] | Stijn Huys[4] | Denis R. Verwilghen[6] | Annabel Braem[3] | Maurice Y. Mommaerts[1,2]

[1]European Face Centre, Universitair Ziekenhuis Brussel, Brussels, Belgium
[2]Doctoral School of Life Sciences and Medicine, Vrije Universiteit Brussel, Brussels, Belgium
[3]Department of Materials Engineering, KU Leuven, Heverlee, Belgium
[4]Department of Mechanical Engineering, KU Leuven, Heverlee, Belgium
[5]Flanders Make, Heverlee, Belgium
[6]Sydney School of Veterinary Sciences, Faculty of Science, University of Sydney, Sydney, Australia

Correspondence
Nikolas De Meurechy, European Face Centre, Universitair Ziekenhuis Brussel, Laarbeeklaan 101 1090 Brussel, Belgium.
Email: de.meurechy.n@gmail.com

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Abstract

The wear of a novel temporomandibular joint (TMJ) prosthesis was evaluated in an animal model. The prosthesis consisted of an additively manufactured titanium alloy (Ti_6Al_4V) mandibular condyle and glenoid fossa created through selective laser melting, with a machined vitamin E-enriched ultra-high molecular weight polyethylene (UHMWPE) surface attached to the fossa. Thirteen TMJ prosthesis were implanted in sheep, six of which had condylar heads coated with HadSat® diamond-like carbon (H-DLC). Euthanasia took place after 288 days, equaling 22 years of human mastication. Linear and volumetric wear analysis of the fossa was performed by optical scanning. The condylar head surfaces were assessed by scanning electron and confocal laser microscopy. The average linear UHMWPE wear, when combined with the coated condyle, was 0.67 ± 0.28 mm (range: 0.34–1.15 mm), not significantly differing ($p = .3765$, t-test) from the non-coated combination average (0.88 ± 0.41 mm; range: 0.28–1.48 mm). The respective mean volumetric wear volumes were 25.29 ± 11.43 mm^3 and 45.85 ± 22.01 mm^3, not significantly differing ($p = .1448$, t-test)