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## Multiscale optimization of implant morphology for osseointegration

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Rapid and stable osseointegration signifies a major concern in design of implantable prostheses, which stimulates continuous development of new implant materials and structures. This paper aims to promote a computational design framework of a bead/particle coated porous surface for implants by exploring how its micromechanical features determine osseointegration through multiscale modeling technique. A typical dental implantation setting was exemplified for investigation. The global responses of a macroscale model were obtained through 48 month remodeling simulation, which forms a basis for the microscopic models created with different particle size, porosity and gradients. The osseointegration responses are evaluated in terms of bone density of peri-implant, BIC ratio and Tresca shear stress (PTS). The response surface method (RSM) was utilized to formulate the bone remodeling responses in terms of the above mentioned design parameters. The multiobjective optimisation was then performed to simultaneously (1) maximize density and uniformity; and (2) maximize BIC ratio and minimize PTS for achieving the best possible overall outcome. Due to strong competition between these two design objectives, a Pareto front is generated. To make a proper trade-off, the minimum distance selection criterion is considered for a compromised optimal solution. This study provides a novel design methodology for individual patient that allow optimizing topographical features for a desirable patient-specific biomechanical environment, thus promoting osseointegration.

### Biography

Wei Li has completed her PhD in 2002 from University of Sydney Australia and Postdoctoral studies from the same University. She is Australian Research Council (ARC) and Australian Reserach Fellow (ARF) since 2010. She has published more than 70 scientific articles in reputed journals.

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