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Title: Study of Natural Bactericidal Surface Production on Titanium Implants for Orthopaedic Applications

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ABSTRACT

In recent years, medical industry is paying key attention to revamp their orthopaedic implant models as current implants are associated with the risk of bacterial infection post-surgery. Antibiotic therapy on the other hand, limits its applications as it inhibits its ability to quell rising infection. Microbes have evolved at a rapid rate to gain the upper hand over environmental pressures. The learned resistance mechanisms are two-fold. Firstly, misuse and overuse of antimicrobial agents has accelerated the mutation of bacteria into multi-drug resistant 'superbugs'. This has spurred efforts to hasten the stalled discovery of new drugs. Secondly, social evolution of bacteria has brought about the 'biofilm' – a multilayer micro-colony highly robust to conventional antibiotic therapy). These issues combine to make implant infection a significant public health challenge. Treatment requires prolonged intensive care, often followed by complicated and costly revision surgery). This puts great strain on health systems worldwide. Therefore, a quest to develop new implant materials with micro/nano-textured surfaces exhibiting inherit resistance to bacteria is growing. Here, a simple patterned surface manufactured by fracture is investigated to determine its anti-biofouling and bactericidal properties. Accordingly, attempts have been made to produce nano-pillar structures by fracturing a small titanium coupon, and characterised by scanning electron microscopy (SEM) and optical profiling, and assayed for bacterial attachment and viability. The fractal-like fracture surface of titanium was populated with micro and nanoscale features. Although these were not able to elicit any bactericidal effect against gram-positive *S. aureus*, the attachment patterns of the bacteria seem to suggest anti-biofouling behaviour. Further investigation into this surface should be undertaken by studying; the anti-biofouling effect quantification, secondly, the testing the surface produced against gram-negative bacteria such as P. aeruginosa, more susceptible to this physical mechanism of action. Hence based on this study int can be summarised that the results show micro- and sub-micro hierarchical structures exposed through fracture may be able to reduce bacterial attachment, however, are not sufficiently uniform or prevalent for any significant antibacterial effect.