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Abstract

In Vitro Bacterial Adhesion on 316L Medical Grade Stainless Steel with Two Surface Finishes †

António Fróis [1,2], Emanuel Cardoso [1,3], Paula V. Morais [3], Romeu Francisco [3,*] and Cristina Santos Louro [1,*]

1 Centre for Mechanical Engineering, Materials and Processes (CEMMPRE), Department of Mechanical Engineering, Faculty of Sciences and Technology, University of Coimbra, Rua Luis Reis Santos, 3030-177 Coimbra, Portugal; antonio.frois@student.uc.pt (A.F.); emanuel.cardoso@student.uc.pt (E.C.)
2 Faculty of Medicine, Biophysics Institute, Coimbra Institute for Clinical and Biomedical Research/Centre for Innovative Biomedicine and Biotechnology (iCBR/CIBB), University of Coimbra, 3000-548 Coimbra, Portugal
3 Centre for Mechanical Engineering, Materials and Processes (CEMMPRE), Department of Life Sciences, Faculty of Sciences and Technology, University of Coimbra, Calçada Martim de Freitas, 3000-456 Coimbra, Portugal; pvmorais@ci.uc.pt
* Correspondence: rmfrancisco@uc.pt (R.F.); cristina.louro@dem.uc.pt (C.S.L.)
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All metallic alloys corrode in the human body. In the specific case of oral cavities, multiple factors—such as diet, hygiene, and health—create an extreme corrosion-promoting environment. The result is the release of metallic ions, some of which, such as Nickel (Ni), exert allergic, mutagenic, cytotoxic, or carcinogenic effects. In modern orthodontics, fixed appliances are commonly manufactured by using stainless steel and NiTi, which show proper mechanical properties and rely on passivation mechanisms to resist corrosion. However, their metallic degradation is inevitable. In particular, biofilm formation can promote intraoral corrosion by generating three types of microcells: those with varying degrees of oxygenation; those with different concentrations of metallic ions; and active-passive cells. The pitting susceptibility of the alloys may thus increase, as well as the wear on the surfaces under sliding [1,2]. However, the clinical effects are still not fully understood. Allergies to Ni, for instance, clearly may occur, but their real extent is controversial. In this study, the in vitro bacterial adhesion of *Staphylococcus aureus*, *Bacillus subtilis* and *Pseudomonas aeruginosa* was evaluated on medical grade SS 316L (AISI) with two different surface finishes: roughing, as received by the supplier (surface A), and mirror-polished, with a 3 µm diamond suspension (surface B). Samples were analyzed by Scanning Electron Microscopy coupled with Energy-Dispersive X-ray Spectroscopy (SEM/EDS) to obtain information on cell morphology, biofilm formation and surface density, while providing insights into material corrosion. Surface colonization was estimated by Colony Forming Unit (CFU) plate counts. The results show that the surface colonization of surface B was significantly better than on surface A. One explanation is related to an easier cell stacking and anchorage through the adhesive extracellular matrix. In this way, *P. aeruginosa* managed to attach in a higher quantity, forming thick, densely populated colonization structures. In contrast, *B. subtilis* showed a low adhesion to the SS surface, regardless the surface finish type. Future work will study the impact of protective hydrogenate amorphous carbon (a-C:H)-based coatings on bacterial adhesion to investigate their effectiveness against microbiologically induced corrosion.

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