



CORPUS PUBLISHERS

Open Access Journal of Dental and Oral Surgery (OAJDOS)

Volume 2 Issue 2, 2021

Article Information

Received date : August 15, 2021

Published date: August 27, 2021

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Opinion

The Oral Microbiota Influences in the Osseointegration Process

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Opinion

The osseointegrable implants in Dentistry has grown as substitute or complementary biomaterial to dental prostheses. Titanium and its alloys have been the first-choice biomaterial due to their properties and potential biocompatibility, the main ones being commercially pure grade IV titanium (TiCP), titanium-aluminum-vanadium (Ti-6Al-4V), and there are major research and current investments betting on titanium-zirconia (Ti-ZrO₂). Biocompatibility principles are a doctrine to be followed in order to achieve excellent osseointegration. However, this concept is not limited to just not generating a foreign body response. Biocompatibility should be understood as the biomaterial ability to be able to restore functional capacity and biomimic organic functions with minimal foreign body response [1]. Furthermore, the definition that osseointegration is an interaction between bone tissue and biomaterial is restricted only to a micro-scale view. Thus, on a nanoscale this interaction will be characterized by an osteoconductive proteinaceous ligament that mediates the bone-implant interface, the peri-implant ligament. However, what will modulate this osseointegrable implant's success will be the surface properties, such as: topography and design, roughness, wettability, chemical charge, oxide layer thickness. All these factors are related to implants and can be changed in their specificity through surface treatments [2]. Besides, considering the biomaterial and its properties, it is necessary to understand how the biology of the oral ecosystem behaves for the planning and osseointegrable implants success. One of the biggest clinical challenges in implant dentistry is periodontal and peri-implant diseases. Implant planning cannot be the same for a patient who has periodontal/peri-implant diseases as one who does not. The thought that "after removing the tooth, periodontal disease does not exist because there is no longer periodontal ligament" is incorrect, because, although it has a different composition and origin, there is an osteoconductive protein framework playing the role of a peri-implant ligament.

Technological advances and innovation in oral microbiology have allowed a better understanding of the role of biofilm in the etiopathogenesis of oral infections. This introduced a paradigm shift with the abandonment of the idealization "one pathogen-one disease" of classic infections to a holistic view, seeing the oral cavity as a reservoir of medical importance species and as a potential entity for the dysbiosis development. Thus, there is a multidirectional and dependent relationship between oral microbiome, immune system and host [3]. Under health conditions, and therefore symbiosis, periodontal and peri-implant microbiota will be different with different compositions. However, in a dysbiotic state this composition will be the same. This difference between the two microbiota will be due to the implant's properties and surface treatments, as well as the roughness and wettability that directly influence the peri-implant region, favoring or hindering microbial colonization. Smoother surfaces favor less biofilm formation, while rougher surfaces facilitate microbial colonization. Wettability and charge will mediate whether symbiont colonization will be smaller or larger, so on hydrophobic surfaces with higher angles, symbiont colonization will be smaller, and vice versa. In addition, one of the biggest challenges is to understand this dysbiosis concept and how it is not Socransky's red complex, and specifically, *P. gingivalis* that will cause the periodontal/peri-implant disease, as these red complex species also exist in periodontal health status. For the oral dysbiotic process to be established, a microbial imbalance that favors periodontopathogenic species is necessary [4]. Failure to choose a combination between the ideal implant and the ideal surface treatment can compromise the osseointegration success. But how do you know the ideal implant and treatment? It depends! How is the periodontal/peri-implant microbiota condition? What is the immunity status? Is there immunosuppression? If so, why? And does the individual have any considerable systemic and/or risk factors that imply and characterize a susceptibility state? The patient has periodontal/peri-implant disease with chronic linear bone destruction, should I use TiCP grade IV? The best biomaterial and the best surface treatment do not exist. Everything will depend on the patient's condition situation. Thus, considering the Neomodern Dentistry holistic view between oral microbiome, immune system and host in implant planning is a way to be followed. Since osseointegration will be unique for heterogeneous patient profiles under different microbiota conditions. And this will directly influence how longevity and success of these implants.

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