Oral biofilm and dental implants: A brief

Sir,

A biofilm is a well-organized, cooperating community of microorganisms. They form under fluid conditions. It is estimated over 95% of bacteria existing in nature are in biofilms. Dental plaque is an example for a host-associated biofilm. Costerton defined biofilm as matrix-enclosed bacterial populations' adherent to each other and/or to surfaces or interfaces.[1] Recent studies suggest that the environmental heterogeneity generated within biofilms promotes accelerated genotypic and phenotypic diversity that provides a form of "biological insurance" that can safeguard the "microbial community" in the face of adverse conditions, such as those faced by pathogens in the host.[2] This diversity can affect several key properties of cells, including motility, nutritional requirements, secretion of products, detachment, and biofilm formation; this diversity better equips an organism or community to survive an environmental stress. Dental plaque represents a classic example of both a biofilm and a microbial community, in that it displays emergent properties, i.e., plaque displays properties that are more than the sum of its constituent members.[2] Dental plaque has the properties of a biofilm, similar to other biofilms found in the body and the environment. Modern molecular biological techniques have identified about 1000 different bacterial species in the dental biofilm, twice as many as can be cultured. Dental implants are a broadly accepted and greatly predictable management modality in replacing natural teeth. Differences in the surface properties of dental implants compared to natural teeth advocate possible differences in the microbial composition of the biofilm forming on these surfaces and, ultimately, to infections around dental implants. A significant proportion of medical implants become the focus of a device-related infection, difficult to eradicate because bacteria that cause these infections live in well-developed biofilms, biofilm is a microbial-derived sessile community characterized by cells that are irreversibly attached to a substratum or interface to each other, embedded in a matrix of extracellular polymeric substances that they have produced. Bacterial adherence and biofilm production proceed in two steps: first, an attachment to a surface and, second, a cell-to-cell adhesion, with pluristratification of bacteria onto the artificial surface.[3] Biofilm formation on oral implants can cause inflammation of periimplant tissues, which endangers the long-term success of osseointegrated implants. It has been reported previously that implants revealing signs of periimplantitis contain subgingival microbiota similar to those of the natural teeth with periodontitis.[4] Biofilms play an important role in the spread of antibiotic resistance. Within the high dense bacterial population, efficient horizontal transfer of resistance and virulence genes takes place. In the future, treatments that inhibit the transcription of biofilm controlling genes might be a successful strategy in inhibiting these infections.[3] Dental implants form another nidus for bacterial infection following surgery when the surface and socket are exposed to the oral environment. Dental implantation may be a direct consequence of periodontal disease; therefore, the underlying microbial infection could threaten successful osseointegration of the implant if a microbial biofilm develops. Periodontal pockets and other oral niches, such as the mucosa and tonsils, are reservoirs for the microbial pathogens that initiate the inflammation of the marginal soft tissue around the dental implants that may lead to implant failure. Reduction in peri-implantitis rates are shown when patients delay implant surgery after tooth extraction and rigorous preoperative and postoperative antibiotic regiments as well as improved dental hygiene are incorporated into the post-operative treatment.[5] The recognition that dental plaque is a biofilm helps to explain why periodontal diseases have been so difficult to prevent and to treat. Periodontal pathogens within a biofilm environment behave very differently from free-floating bacteria. The protective extracellular slime matrix makes bacteria extremely resistant to antibiotics, antimicrobial agents, and host defense mechanisms. Mechanical removal is the most effective treatment currently available for the control of dental plaque biofilms. Biofilm formation on oral implants can cause inflammation of peri-implant tissues, which endangers the long-term success of osseointegrated implants. It has been reported previously that implants revealing signs of peri-implantitis contain subgingival microbiota similar to those of natural teeth with periodontitis. Future control and treatment of biofilm research will affect the success rate of dental implants.

References

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Rajiv Saini

Department of Periodontology and Oral Implantology,
Rural Dental College-Loni, Maharashtra, India.
E-mail: drperiodontist@yahoo.co.in

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