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Mini Review

Presumptive Indicators of Oral Biofilm Formation: A Selective Approach

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Abstract

Biofilms have been studied using various diagnostic tools and techniques such as Microtitre plate method, bright field microscopy, epifluorescence microscopy, scanning electron microscopy etc. These advanced techniques are costly and have limited access. The present text highlights some important presumptive indicators of biofilm formation in the host body, and further need to explore such indicators.

Keywords: *Oral Biofilm Formation; Microtitre Plate Method; Bright Field Microscopy; Epifluorescence Microscopy; Scanning Electron Microscopy*

Introduction

Oral cavity is a complex microbial ecosystem. A number of organisms present in the oral cavity have been reported to colonize the dental surfaces or other extraneously implanted devices, and act as infectious niche. With ever growing menace of biofilms, the combat and control machinery seems to be the top priority to curb the adversities. Further, an accurate and precise diagnostic method is the key to an efficient biofilm control and elimination. Various diagnostic tools and techniques such as Microtitre plate method, bright field microscopy, epifluorescence microscopy, scanning electron microscopy etc. have been employed to understand the colonial formations and the dynamics of miniatures. However, these advanced techniques are costly and have limited access. Thus, the judicious use of any advanced diagnostic procedure could be made profitably by selective analysis based on presumptive indicators. The present text attempts to precisely highlight and stress the need to further explore some important presumptive indicators of biofilm formation in the host body.

Biofilm formation: Analytical tools

Over the years, different methods have been used to establish the presence of biofilms on biotic and abiotic surfaces. Microtiter plate method is one of the widely used analytical methods for biofilm formation [1]. Besides this biofilms could be detected using scanning electron microscopy, confocal laser scanning microscope (CLSM), epiflourescent microscopy, viable plate count determination, total protein estimation, absorbance method at 550 nm or 950 nm [2]. Tryptophan fluorescence, endotoxin analysis and total ATPase activity have also been enlisted for detection of biofilms [2-6]. Radioisotopic and non radioisotopic methods have been described for measurement of activ-

ity of the destructive and non destructive biofilms [7]. Molecular methods like amplicon length heterogeneity polymerase chain reaction has been used to assess the diversity of the microbial community in biofilms [8]. The differential expression of proteins in biofilms has been considered as another reliable approach to identify the biofilm specific proteins, thus act as the basis of diagnosis and treatment. Similarly, the literature quoted that extracellular matrix proteins could also be a promising biofilm diagnostic tool.

However, a recent editorial column while stressing the need for development of novel diagnostic and therapeutic strategies to manage biofilm associated infections stated that the early recognition of biofilm-associated infections still represented an unmet need in clinical microbiology [9].

Biofilm formation: Presumptive indicators

It has been documented earlier that clinical microbiologists adopted Parsek-Singh biofilm criterion, which precisely defined the association of pathogenic bacteria to the surface or their attachment to the substratum, and that the bacteria could be visualized in clusters encased in matrix of bacterial or host constituents. Moreover, criteria also stated that the biofilm infection was localized and resistant to antibiotic treatment even when the bacteria were susceptible to the same antibiotic during their planktonic state [10].

Apart from this, different studies have documented a correlation between biofilms and antibiotic tolerance [11-13]. Biofilms could tolerate up to one thousand times more minimal inhibitory concentration as compared to their planktonic forms [12]. Further, it has also been revealed that the cells might detach individually from biofilm as a result of cell growth and division within the biofilms. Even the detachment or sloughing off of the cell aggregates from the biofilm has been reported, and that the erosion of the cells from biofilm has been attributed to an increase in shear stress [14]. It has been reported that biofilm bacteria tend to escape host defenses leading to chronic infections. Biofilms have also been stated to be safe niches which could evolve resistant organisms possibly through resistant plasmid exchange.

As pointed in preceding paragraph, the biofilm dynamics pointed to the association of biofilms to emergence of drug resistance, incidence of recurrent infections and chronic infections. Thus, regardless of the reason, drug resistance episodes, the recurrent infections, chronic infections, and incremental release of the infectious miniatures from the host body could be thought of presumptive indicators of persistence of pathogenic biofilms in general or oral biofilms in particular.

Conclusion

Efforts to further explore consistent positive correlation of pathogenic biofilms to recurrent infections, chronic infections and drug resistance could establish these infectious states as presumptive indicators of pathogenic oral biofilms, and could be useful in carving out newer biofilm therapeutic approaches.

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