1678 Quantitative Analyses of Adhesion and Aggregation of Actinomyces Species Using Atomic Force Microscopy

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Objectives: Actinomyces species are predominant early colonizers of oral cavity, and mediate inter-bacterial adhesion or coaggregation. The previous methods that evaluated the adhesion of Actinomyces spp. by quantitative assessment of cells attached to substrates, did not quantify the interactive forces between bacteria and substrates. Therefore we used atomic force microscopy to quantitatively analyze adhesion and autoaggregation of Actinomyces spp. in the nanoNewton (nN) range. Methods: A total of eight strains belonging to eight species of Actinomyces were employed, namely A. bovis, A. gerencseriae, A. israelii, A. meyeri, A. naeslundii genospecies 1 and 2, A. odontolyticus and A. viscosus. The sterile pelco mica discs, used as the adhesion substrate, were immersed in mono-species bacterial suspensions, for 5 days to obtain a thin bacterial biofilm. Interactive forces were obtained using cantilevers of silicone nitride and a Nanoscope III atomic force microscope (Digital Instruments, Santa Barbara, CA, United States) operated in the contact mode, in air. Three different interactions were quantified at the cell surfaces (tip-cell), the periphery of cells and the substrate (cell-mica) and the interface between cells (cell-cell). Results: When the three interactions of the same Actinomyces were compared, A. gerencseriae ($p<0.001$), A. viscosus ($p<0.01$) and A. israelii ($p<0.05$) demonstrated greater cell-cell interactions than tip-cell and cell-mica interactions. When the same interactions of different Actinomyces spp. were compared, A. naeslundii genospecies 2 showed the greatest tip-cell interaction (-32.569±8.729nN, $p<0.01$). A. naeslundii genospecies 1, 2 and A. viscosus demonstrated greater cell-mica interactions than the other five species ($p<0.05$). A. viscosus (-34.625±10.451nN) displayed greater cell-cell interaction than the others ($p<0.01$), except for A. gerencseriae ($p>0.05$). Conclusion: The data indicate that the fimbriated Actinomyces spp. possess a higher interactive adhesive force and ability to autoaggregate than those devoid of fimbriae. (Supported by the RGC (10202943) and CRCG (10203286 and 10203775) in Hong Kong).

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