

from gingival tissues using oral mucosal transudate, are entirely based on proteome analysis.

5.2 Development of Biomarkers

The two main research frontiers for application of proteomics in dentistry are salivary diagnostics, or oral fluid biomarkers, and proteomics of bone and enamel. While saliva is accessible and its collection is totally noninvasive, its use in clinical diagnostics has only recently been demonstrated. One team of researchers at UCLA, and others, has shown that oral fluid harbors the same composition of disease biomarkers as blood, but in smaller quantities. These scientists have developed, with support of the National Institute of Dental and Craniofacial Research, a molecular sensor that provides the basis for future development of the "Oral Fluid NanoSensor Test (OFNASET)." OFNASET is predicted to be a handheld and easy-to-use instrument that clinicians can use to rapidly detect complex salivary protein and nucleic acid targets. The result will be the ability to clinically detect oral cancer before oral signs and symptoms²⁸.

5.3 Genetic single nucleotide polymorphisms

Several researchers have focused on genetic single nucleotide polymorphisms in the study of periodontal disease. A genetic susceptibility test is available for severe chronic periodontitis (Interleukin Genetics, Waltham, Massachusetts). It works by detection of two types of IL-1 genetic alleles, IL-1 α + 4845 and IL-1 β + 3954³⁰. Individuals identified as "genotype positive," or are found to have both of these alleles, are more likely to have the phenotype of overexpression of this gene.

5.4 Computer Technique

A computer technique which attempts to fit millions of small molecules to the three-dimensional structure of a protein is called "virtual ligand screening". The computer rates the quality of the fit to various sites in the protein, with the goal of either enhancing or disabling the function of the protein, depending on its function in the cell. A good example of this is the identification of new drugs to target and inactivate the HIV-1 protease. The HIV-1 protease is an enzyme that cleaves a very large HIV protein into smaller, functional proteins. The virus cannot survive without this enzyme; therefore, it could be one of the most effective protein targets for killing HIV⁶.

5.5 Development of Newer Drugs

One of the most promising developments to come from the study of human genes and proteins has been the identification of potential new drugs for the treatment of disease. This relies on genome and proteome information to identify proteins associated with a disease, which computer software can then use as targets for new drugs. For example, if a certain protein is implicated in a disease, its 3D structure provides the information to design drugs to interfere with the action of the protein. A molecule that fits the active site of an enzyme, but cannot be released by the enzyme, will inactivate the enzyme. This is the basis of new drug-

discovery tools, which aim to find new drugs to inactivate proteins involved in disease. As genetic differences among individuals are found, researchers expect to use these techniques to develop personalized drugs that are more effective for the individual⁶.

6. Conclusion

The use of proteomics and gene expression will advance the diagnosis and treatment of various oral pathological conditions. In periodontium, many but not all expressed proteins are tissue-specific and the function of various proteins is modulated by multiple factors, including interactions with other proteins and modifications arising from attached phosphates, sulfates, carbohydrates, and lipids. Proteomics can provide comprehensive and systematic information about proteins in a wide array of tissues and organs. An important challenge that needs to be met by research workers in periodontology is to embrace proteomics approaches when appropriate, and start to apply them to critical, unresolved questions such as the biological basis for the heterogeneity in gingival, bone, and cementum cell populations. Advances in tissue engineering, drug delivery, gene therapy and biopharmaceuticals will present new therapeutic opportunities. However, its application into the field of dentistry depends on how best oral health care practitioners will incorporate this into their practice.

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