Proteomics and Genomics: An Awesome Diversity in the Periodontal World

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Abstract

Proteins are the base structure for both the microorganisms as well as for the periodontal tissue. The periodontitis complex array is chiefly built by the cascade of a myriad of protein molecules. Hence, the science as well as the study of the complex molecule proteins as biomarkers in the periodontal world, has brought into the main focus since. This complex protein is the main factor in the development of the pathogenesis of periodontitis. Thereby, it is very much used as a diagnostic biomarker. The sound and rich facts of many proteins concerned in oral pathogenesis can be applied in the analysis, avoidance and management of periodontal disease. Hence, this review topic has been considered to understand the basics of the role of Proteomics and Genomics in the field of Periodontology.

Keywords: *Proteomics, Proteins, Periodontitis, Biomarkers.*

Introduction

A human cell operates because of the protein molecules present in them. As we know, every organic molecule subsides in our body is in the form of either a protein or the total resultant activity by the protein molecules. The phrase "proteome" is anamalgamation of the phrases "protein" and "genome" found in the mid-1990s by Marc Wilkins, an Australian geneticist. The proteome is the whole balance of proteins, prepared to a meticulous set of proteins, formed by aliving being. The same will fluctuate with certain period and individual needs, that a cell or creature faces. The word "proteomics" was primarily focused in 1997 to create a comparison using genomics, the learning of the genes. Proteomics is described as the learning of every proteins together with their comparative loads, circulation, posttranslational modifications, actions, and communications with various macromolecules, in a particular cell or organism within a given surroundings and at a definite phase in the cell series.[1]

Proteomics is a comparatively new 'post-genomic' knowledge with vigorous and full-blown potential. It is now accepted as the successful protocol during the research in the biological system. It comes just after the genomic study and the transcriptomics study.

It is considered as the most intricate and complicated procedure than the genomics. As we know proteomics is much more complicated than genomics mostly because the genome in an organism is quite and considerable and maintains the constant feature, whereas the proteomics keeps on fluctuating with time and with different types of cells. This shows that the basic protein sets produced by the cell requires an exact calculation.[2]

Proteomics and General Dentistry: The two key places where dental proteomics encompass revealed are 1. Salivary diagnostics and 2. Proteomics of bone and enamel. The saliva of the human being possesses proteins that can be useful for infection recognition and scrutiny of oral fitness. The broad chemical scrutiny

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and recognition of the proteomic particles in individual saliva is an essential initial footstep in the direction of the invention of saliva protein markers in oral diseases like Sjogren's syndrome. Particularly the proteomic biomarkers of the saliva have been recognizedfor three features, namely the process inflammation, degradation of the collagen, and turnover quality of the bone. Hence it ensures a diagnostic as well as a therapeutic approach with the help from the whole saliva content.[3]

Proteomics and Periodontics: Of late, with the help of the immunological method, the study of the fibroblast protein expression from periodontal ligament has been focused and studied extensively. Even though this system is restricted to earlier recognized proteins for which exact antibodies are obtainable. A sum of around 117 proteins been recognized out of the fibroblasts of the periodontal ligament. It can provide or present itself as a suggestion map for upcoming clinical studies and also at the same time for basic research.[4] Broad proteomic research is done on *P.gingivalis*. The chemicalanalysis of the complete proteomic cell have been carried out to explore the transformation from an extracellular to intracellular lifestyle for *P.gingivalis*.[4,5]

Salivary Proteomics for Periodontitis: Saliva is considered as an important periodontal diagnostic tool because of its various proteins present which acts as a potential biomarker in periodontitis. Young-Jin Choi et al studied the GCF in healthy individuals and periodontitis patients to study biomarkers. In GCF he spotted azurocidin known to be the upregulated protein in case of periodontitis case but never could spot the same in the saliva. This made him draw a conclusion saying that azurocidin can be a very significant and important biomarker for detecting early periodontal destruction in a prone patient. However, the protein detected azurocidin can also play as an inhibiting factor for the differentiation of osteoclasts and thereby can be a great boon for checking the alveolar loss in the early periodontitis stage.[6]

Customized Drugs: Proteomics and Genomics helps in discovering the new potential drugs for the disease treatment. To make the drug act successfully on the targeted disease, the information of the proteome and the genome data is mandatory for recognition of the particular protein which is causing the underlying disease. And once the protein is recognized, the help of the computer software is taken to find the chemical formula or the 3D structure to provide the data to design the customized drug, required for the deactivation of the particular protein which is the source of the disease. Once the molecule fits into the target and active site of the enzyme, and fails to get released anymore by the enzyme, the deactivation of the enzyme takes place. This is the standard protocol of new drug formation, and in turn it helps to locate the novel drugs to deactivate the involved protein in the disease. However, researchersutilize this procedure to procure personalized drugs effective for the person, as many genetic differences are found among individuals.[7]

Development of Biomarkers: The two most important research ground for implication of proteomicsin dentistry are salivary diagnostics, or oral fluid biomarkers, and proteomics of bone and enamel. As saliva is easily reached and simple collection procedure and also non-invasive, its appliance in clinical diagnostics is uncomplicated. "Oral Fluid Nano Sensor Test (OFNASET) is an advanced test for identifying the salivary proteins which are not easily detected. The consequence will be the capability to clinically identify oral malignancy ahead of its oral signs and symptoms.

Computational Method: There is a method attempted by a computer known as"Virtual Ligand Screening". This method has the property to adjust billions of very tiny molecules into the structure which is the three-dimensional structure of a protein. The computer efforts its caliber or the standard to meet the required purpose of the targeted protein sites. The main goal is to either intensify or to deactivate the meaning of the protein,checking on its position in the cell. An excellent exemplar of this is the recognition of novel drugs to aim and deactivate the HIV-1 protease. The HIV-1 protease is aboon enzyme that splita very bulky HIV protein into slighter, purposeful proteins. The above virus can neversustain without this enzyme; hence this protein aims at killing HIV.[8,9]

Limitation: As protein expression and post-translational modificationsare vibrant processes, particularly in the periodontium, recognition and frequency analysis of proteins only are notenough to appreciateits functional changes. The latest development in science will be essential to permit combinations of metabolic grouping and recognition and the frequency analysis of the rate of synthesis. Also Proteomicshypothesis conducted in a particular laboratory may notbe able to get reproduced in another laboratory.[4]

Future Directions of Genomics And Proteomics:

Single-Nucleotide Polymorphism: At present, several investigators are seriously focusing on the genetic single-nucleotide polymorphisms in the dental field. Right now, there seems to be the availability of a genetic vulnerability test for the diagnosis of severe chronic periodontitis shortly. Also, it helps in forecasting the salivary IL-8 levels to recognize if by chance the individual is vulnerable to squamous cell carcinoma.[9]

Nucleic Acid Probes: DNA probes were invented to recognize the sequences of nucleotide for a particular species of bacteria, hoping to be a fantastic diagnostic value. And both DNA and RNA probes are easily procured today for the research and daily practice. It is very much expected shortly, the laboratories for the mini molecules will come up, and the mini molecular kit will be obtainable for chair-side DNA probe.However, the guidance of a microbiologist might still at times be essential to keep away from trouble that may happen in the diagnostic procedure.[5]

Infrared Spectroscopy: Infrared spectroscopy (IRS) describes in detail the intricate biologic systems by captivating the fully IR spectrum which represents the summation of all the biomolecules present. The IR spectrum of the sulcular fluid is a loaded supply of fantastic data relatingto inflammation. IR analysis of GCF, counts the entire possession of the GCF and may provide evidence as a commanding diagnostic and prognostic means for periodontal diseases.[5]

Near-Infrared Spectroscopy: Near-Infrared Spectroscopy (NIR) is capable of keeping an eye on hemodynamic and edema-based markers of soft tissues like gingival inflammation.(5)

Molecular Biologic Technique: It uses the bacterial genome as a way of spotting the particular bacteria. DNA obtained from the dental plaque, are here critically analyzed during nucleic acid probes technique or polymerase chain reaction (PCR). Bacteria can be recognized when DNA obtained from dental plaque is send for the hybridization process, with group definite probes that are branded to permit visualization. Checkerboard hybridization is a method that utilizesthe probes at the same time for testing up to 43 bacterial variety. PCR implicates a DNA replicating enzyme (polymerase) to magnify the targeted DNA sequencing. The usage of standard PCR is not encouraged much as it is only limited to quantitative evaluation of recognized bacteria, although a technique called real-time PCR goes for the recognization of a particular species.[2]Now is the time for nanomaterials and microelectronics for the realistic operation with miniaturized sensors, appropriate for a range of significant applications. The latest Nano-Biochip technology processes fluids to supply a digital fingerprint that can be linked with the local chemical situation, detecting pH, electrolytes, metal cations, sugars, toxins, proteins, and antibodies.

Progress of Rapid Point-Of-Caree and Nano-Biochip: The progress of rapid point-of-care (POC) chair side diagnostics has the caliber for the before time recognition of periodontal illness and development and to diagnose it in the embryonic phase and lessen health concern expenditure.(identification pathogen).[6]

Circulating Micro RNA's As Biomarkers: Micro RNAs are post-transcriptional regulatorsto recognize disease-specific expression patterns. It can diagnose both the malignancy as well as the benign diseases.[8]

Tandem Mass Spectrometry: To carry the huge-scale proteomic analysis of GCF, utilizing gel electrophoresis for protein separation or "shotgun" approaches.It is taught that the knowledge of the crevicular fluid is mandatory to spot the healthy along with the important risk potential biomarkers.[1, 6]

Microfluidic Immunoassays: It is a fast saliva-based clinical method to diagnose the risk proteins which may cause the disease.It is carried by the saliva analysis by integrating sample pre-treatment with electrophoretic immunoassays.[3]

Salivary Proteome Project: This is by using the proteomic method, a standard proteome plot of the individual whole salivapermits for the resolution of bigger than 200 protein spots in a single two-dimensionalpolyacrylamide gel is carried out, which says it will spot the vulnerable candidates for carrying the particular disease. It is of great diagnostic and therapeutic significance.[3,10]

Conclusion

The utilization of proteomics and gene expression will move ahead of the identification and dealing of different dental pathological circumstances. There seems to be a huge opportunities therapeutically for the genomic therapy, tissue engineering, local drug delivery, and simultaneously biopharmaceutical and definitely

will flourish. However, but not impossible, its entry into the area of the dental field depends on how finest dental doctors will fit this into their tradition as it demands meticulous information of individual genetics and implement of novel analytic and remedial technologies.

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