Poster journal

Epigenetics – Cutting Edge in Oral Health Research

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Commentary

Oral health is essential to general health and quality of life. The most common oral diseases being dental caries, periodontal diseases, oral cancer, oral infectious diseases, traumatic injuries etc. Worldwide, 60-90% of school children and nearby 100% of adults have dental cavities, often leading to pain and discomfort. Globally, about 30% of people aged 65-74 yrs have no natural teeth.[1]

Oral health is determined by various factors like environmental, biological including the intra –uterine environment and genes. There is direct evidence for genetic component in the aetio-pathogenesis of various diseases.[2,7,10] However, the basic structure and function of DNA does not completely explain all the underlying mechanisms of gene regulation and disease development. ***"Epigenetics may provide the missing link to these unanswered questions"***.

Researchers, physicians, and others poked around in the dark crevices of the gene, trying to untangle the clues that suggested gene function could be altered by more than just changes in sequence, the so called epigenetic changes. The science of Epigenetics which literally means ***"control above genetics"***, profoundly changes our understanding of how life is controlled. Epigenetics provides an understanding of the role of gene environment interactions on disease phenotype especially in complex multifactorial diseases. The known or the suspected drivers behind epigenetic process include many agents, including heavy metals, smoke, bacteria, viruses, basic nutrients, hormones, stress etc.[3] DNA transmission can be explained as two mechanisms, the nature or the innate qualities and the nurture or behavioural traits. These environmental factors can modify or alter the epigenome (primary signal) indicating What, Where and When genes should be turned on or off. These can altogether alter gene expression.[4,5]

"Genomics considered as tip of iceberg, Epigenetics as bottom of the iceberg"

According to Shaffer et al. there are many genes related to the composition and structure of dental enamel, inherited alterations in sugar metabolism and genetic regulation of salivary gland function. But no single gene that directly regulates dental caries initiation or progression has been identified.[2] Epigenetics investigates the molecular mechanisms that link genetic and environmental cofactors to disease outcome. There are many complex mechanisms underlying epigenetics alterations such as DNA methylation, histone modification and gene regulation by non coding RNA, of which DNA methylation is the most common. It seems to be the primary mechanism to suppress retro - transposable elements

which are responsible for creating genetic variation and on occasion, disease causing mutations within the human genome.[6] Recent studies have shown, epigenetic modification of environmental factors can alter the virulence of pathogens in periodontal tissues. They can also modulate the production of inflammatory mediators, expression of cytokines and thus contribute to the pathogenesis of various infections and inflammatory disease.[7] Studies reported that inflammatory reaction in infected pulp and periapical tissue can cause change of gene expression. Biomedical literature demonstrates histone deacetylase inhibitors (HDACi's) anti inflammatory effect combined with its ability to induce host derived antimicrobials attract several therapeutic responses, including stem cell differentiation and improved regenerative responses like tertiary dentinogenesis.8 Brook proposed that dental anomalies are results of genetic – epigenetic interactions.[9] Recent evidence suggests that epigenetic modifications induce tumorigenesis and play a more central role in evolution and progression of oral cancer. Recent studies show prospect of biomarkers for early detection and indicators of disease recurrence and novel treatment modalities for oral cancer.[10]

Epigenetic changes occur more frequently than the genetic changes and are rendered reversible by treatment with pharmacological agents.[6] Therefore, understanding changes may be useful for developing early diagnostic markers and therapeutic methods to treat various oral diseases. Studies suggested that if, pharmacological agents targeting the specific epigenetic sites are identified, it could reverse the whole mechanism leading to primordial or primary prevention. ***Application of these approaches may reduce oral health related morbidity and mortality of tooth.***

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