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GENETICS AND DENTISTRY: A REVIEW

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ABSTRACT

Genetic includes genes and hereditary which is the part of biology. Gene is primary responsible for transferring multiple heredity triad. It can be physical, linked to certain illness and disabilities that can transfer from generation to generation. Genetic can also manifest oral health in many ways starting from various developmental problem to precancerous and cancerous lesion. But people are still lack of information on genetic disorder and how to take precautionary measures. To avoid the disease relating to genetics, it is essential to know the etiology of disease and help with early diagnosis of high risk of patient. This article aims to provide information about genes in dentistry.

Keywords: Genetics, Mutation, Dentistry

INTRODUCTION

Genetics studies the methods and outcomes of biological inheritance transmission and generation **[1]**. it is a specific unit of heredity found in chromosomes, consisting of an entire DNA sequence is required for the synthesizing functional polypeptide or RNA sequence **[2]**. Each gene is responsible for a particular trait or feature in an individual; the deletion or addition of genes causes those characteristics to emerge, resulting in a character, malformation, or disorder, depending on the circumstance **[3]**.

A tooth is a specialized unit of the maxillofacial skeleton that is created by a sequence of intricate steps. Inductive interactions between epithelial and mesenchymal cells regulate tooth growth, which is genetically controlled.Hereditary conditions have played a main role in the periodontal disorder, dental caries, dental abnormalities, and other oral and maxillofacial disorders. To determine the main cause of disease in human genome most initial step is to identify the mutated gene. This method has significantly improved the feasibility of imaging hereditary conditions over time. The importance of genetics in the interpretation of multiple dental disorders and abnormalities is becoming increasingly apparent **[4, 5]**.

Role of genes in different diseases-

Dental caries

Dental caries begins with decalcified tooth's inorganic components. The degradation of the organic matrix is accompanied by the loss of mineral material **[1, 2, 6]**. Genes are responsible for 35–55 % of caries phenotypic heterogeneity in the permanent teeth. Many predisposing variables are also included. Dental caries is increased by inherited disorders of tooth growth, salivary flow, and immune system **[7, 8]**. In dental caries, genetic modification is used to create transgenic strains of Streptococcus mutans that lack a certain gene that causes decay **[9]**.

Periodontal disease

According to several syndrome findings, genetic causes are responsible for 50% of periodontal disorder susceptibility. Fragile periodontal tissue and early periodontitis are linked to a number of hereditary abnormalities **[10]**. Gingival enlargement is described as the proliferation and accumulation of connective tissue in the gingiva. It may also be caused by chronic gingival inflammation or drug-induced gingivitis **[11]**. Hereditary as an X-linked is ruling feature for easily resulting of periodontal disorder. Loss of attachment, formation of pocket, gingival and plaque index have all been identified in various studies **[12]**.

Many studies have primarily focus on genes that modulating the immune responses to antigen recognitionfor periodontitis susceptibility factors.Cytokinesare main mediators of inflammatory reaction during periodontitis.It helps in activating, proliferating and differentiating B cells, which are infiltrating cells in early stage of periodontitis. As a result, widespread differences in genetic code can affect disease progression **[13-15]**.

Oral cancer

Oral cancer is also becoming the main cause of death. Many people with habit of

smoking, consumption of alcohol and tobacco has increased risk of developing the disease. Extrinsic cause includes Tobacco, smoking, syphilis, sunlight, and radiation. Intrinsic cause includes general starvation also iron deficiency anemia. Tumor suppressor genes and oncogenes are chromosomal elements that can be influenced by a number of factors **[16]**.

In maxillofacial region squamous cell carcinoma, smoking and tobacco consumption have been linked to p53 gene mutations. p53 expression also found in oral tumors from heavy smokers and drinkers using immunohistochemistry **[17]**. Multiple "hits" to DNA, according to studies, are needed to cause cancer. Indirectly, it contributed to the discovery of cancer-related genes. Many syndromes haveincluded in predisposition of cancer **[18, 19]**.

Malocclusion

Tooth form and texture, jaw location and size, growth rates, and the impact of soft tissues on dental hard tissues all play a major role in dental occlusion.[8]Various experiments are carried out on the stages of growth of molars I and II, the craniofacial complex, palatal width and height and so on. Many studies reported that dental growth is genetically determined and inherited factors also plays a main role in malocclusion **[20]**.

Tooth agenesis

The loss of tooth growth is referred to as tooth agenesis. Tooth agenesis affects one or two teeth in humans. The most common agenesis is the failure of the third molars to mature. While environmental factors may sometimes trigger agenesis, genetic factors became a common cause **[4]**. Non-syndromic hypodontia/oligodontia has been linked to a number of genes.

PAX, MSX, EDA, LHX, BARX, DLX, AXIN, and RUNX are the main genes involved in tooth agenesis. MSX1 is involved in craniofacial formation, which includes odontogenesis. Vastardis *et al*. discovered an Arg to Pro substitution in the MSX1 gene homeodomain that results in hypodontia and is passed on over the next four generations. The PAX9 gene, which codes for a transcription factor, plays a role in tooth growth. Orofacial disorderis caused by genetic variation in these genes, which affects tooth development **[21-23]**.

Ectodermal dysplasia

Ectodermal dysplasia causes by a EDA1 gene mutation. Hypoplasiaor the lack of sweat glands, sparse hair, thin skin and pronounced oligodontia are also symptoms of this rare disease. Song *et al*. discovered three new EDA gene mutations in male individuals from 15 non-syndromic oligodontia patients in 2009. Mutations of WNT10A gene can induce non-syndromic hypodontia, according to research in 2011 **[24]**.

Amelogenesis Imperfecta (AI)

Amelogenesis imperfecta is a condition that changes the function and appearance of enamel due to a genetic mutation. It includes autosomal dominant or recessive, sex-linked, and intermittent. According to genetic molecular techniques amelogenin gene is seen in distal part of the X chromosome's short arm and in the peri-centromeric part of the Y chromosome **[25, 26]**. AMELX, ENAM, and MMP 20 have structural gene mutations that causes AI **[27]**.

Dentinogenesis imperfecta

Dentinogenesis imperfecta is characterised by translucent and discoloured teeth. Individuals with this condition have weaker teeth than average, which contributes to tooth wear, breakage, and tooth loss. It includesfracture teeth and pitting enamel. Both primary and permanent teeth affected. Individual can have Malaligned teeth and speech problem. It can be due to mutations in the DSPP gene and also it is inherited in an autosomal dominant manner **[28, 29]**.

CONCLUSION

Dentists are the first to protect against oral disorder and the outcome of complex diseases of orofacial region. According to many studies reports, mutation of gene has played amain role in many oral health conditions. As a result, an oral health practitioner must be mindful of developments in molecular biology and genetics in order to diagnose a high-risk person early, raise consciousness, and advise the person, thus implementing an early warning approach and applying it. A health provider who understands biology will have a more tailored standard of treatment. With advances in science and information, a world of customized drugs is on the rise, where patients can be prescribed medications depending on their genetic makeup. Furthermore, there is a lot of need for more study in this area.

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