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Person 'omics': the future of personalized dentistry

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Abstract
With the increasing modes of awareness on various platforms there is a recent apparent shift to move away from a traditionally reactive model of medicine toward a predictive/preventative one. Precision medicine (PM) is personalized medicine that may create customized medical treatments for each patient. "Omics" sciences enable the integration of data to create extremely accurate models of how each patient's unique biological system will behave. They allow for quick diagnosis, evaluation of illness dynamics, design of specialized treatment protocols, and a decrease in expenses and mental stress. Present review gives a brief overview of Precision medicine in context of dentistry with a note on future scope.

Keywords: Personalized dentistry, salivary biomarkers, Saliva, Omics

Introduction
A growing number of patients, clinicians, and scientists are searching for a more individualized method of illness prevention. Predispositions encoded in a patient's genomes at birth are combined with the patient's lifestyle choices and environmental circumstances to determine disease risks. Precision dentistry and medicine are based on the ability to distinguish a diseased person from others who have similar clinical manifestations. [1]
Personalized medicine (PM) is a progressing area in which physicians use diagnostic tests to identify particular biological markers, often genetic, that aid in describing which medical treatments, as well as technique, will work best for each patient. It is also known as - Genomic medicine or Precession medicine [1].

Aims of PM
1. Directing tailored therapy and minimizing error-prone methods
2. Reducing negative drug responses
3. Increasing the treatment-acceptance rate of patients
4. Reducing intrusive, high-risk testing methods
5. Helping to reduce the total cost of healthcare

Complexity of cellular functions
The term "Omics" refers to a collection of sophisticated technologies used to investigate the functions, interactions, and behaviors of the various kinds of molecules that make up an organism's cells N [2]. The central dogma of molecular biology is a theory stating that genetic information flows only in one direction, from DNA, to RNA, to protein and from proteins to its metabolites. Each component from this theory can be analyzed and its corresponding Omics demarcates the basis of PM. They are as follows: (Table 1)

Role of Salivary Biomarkers in PM
Various body fluids can be used to study the different components of Omics. One amongst them is the saliva. The salivary biomarkers act as sentinel molecules that could be used to scrutinize health and disease surveillance [3]. Since various methods of collection and transportation of saliva are safe, simple, and a non-invasive, saliva is considered to be one of the commonly studied bodily fluids. The various components in saliva can be either obtained from oral or the extra oral sites. The complex mixture of DNA, RNA and proteins can be obtained from-blood, salivary glands, oral mucosal cells or the oral microbiota and viruses. In relation to extraoral sites, it obtained from blood via diffusion. Thus oral cavity acts like a sentinel organ for various systemic diseases and hence making the concept of oral signature unique to each individual along with oral macrobiotic [4]. Dysbiosis in oral microbiome not only leads to periodontitis and dental caries along with malignancies such as head and neck squamous cell carcinoma but also other systemic conditions such as endocarditis, atherosclerosis, diabetes and many more systemic conditions [5].

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Personalized dentistry

Dental caries, chronic periodontitis, or facial pain, and oral cancer are a few examples of Complex dental diseases where the use of personalized medicine has the potential to lessen the chronic and frequently destructive nature of these disorders by adopting a more proactive, wait-and-see approach to disease diagnosis and therapy [6, 7]. The discovery of clinically validated biomarkers that can be consistently linked to a particular disease and give dependable targets for therapy will be crucial to the effective application of personalized medicine in dental practice [8]. There are several cases when the successful application of clinically validated biomarkers has been efficiently utilized in the diagnosis and treatment of cancer, even if predictive biomarkers for the most chronic diseases remain elusive [9].

1. Precision Medicine and Strategies for Prevention and Treatment of Oral Cancers

Squamous cell carcinomas (SCC) account for at least 90% of neck and head cancer cases. In this the most frequently mutated oncogene in general is PIK3CA, which encodes for the catalytic subunit PI3K [10]. Additionally, genetic markers that may allow for personalizing treatment approaches for various diseases, such as cancers of the head and neck, are being looked into as part of PM's mission to find effective dental therapies. In particular, trial treatments for squamous cell carcinomas (SCC) are already in place [11]. There are already many potential targets for cancer treatment that can be found thanks to genomics, but there is still more to be done with relation to SCC. The receptor tyrosine kinase EGFR was one of the first therapeutic targets found for this particular tumor type, and combining it with radiotherapy or chemotherapy has produced positive results in terms of disease management [12]. By identifying individual risk factors, PM is seeking to clarify cancer preventive alternatives in addition to its focus on therapy. PM, or personalized medicine, examines a person's genetic makeup as well as his or her personal and family history, as well as the environmental influences to which the person is exposed [13]. Best-known and most-studied risk factor is human papillomavirus (HPV); which is commonly associated with oral and oropharyngeal carcinomas.

TNM staging is used to categorize disease severity and prognosis, although this index does not take numerous patient factors into account, such as age, sex, and systemic inflammatory response. Lin *et al*, conducted a study on 169 patients with tongue squamous cell carcinoma in order to identify independent prognostic indicators linked to patients overall survival. The results of time dependent C-index for the overall survival showed that normogram had better discriminative ability than that of tumor/node/metastasis stage [14].

Researchers have also looked into the accuracy of salivary biopsy in the early detection of head and neck cancer. It is possible to isolate cell-free DNA (cfDNA) and cell-free mitochondrial DNA (cfmtDNA) from saliva samples using a reproducible, non-invasive technique. These markers are believed to be accurate predictors of the severity and prognosis of certain malignancies [15].

2. Precision Medicine and Orofacial Clefts

A widely diverse family of congenital abnormalities includes or facial clefts. Amongst them about 70% are the nonsyndromic cases. The ocular, cardiovascular, and skeletal systems are the most commonly damaged areas in these 70% nonsyndromic cases, whereas clefts fit into syndromic images (the most common and well-known syndromes are Pierre Robin syndrome and Van Der Woude syndrome).

In a retrospective study conducted in Bartzela *et al*. 2021 [16], looked into transmission patterns by examining a sizable sample of patients and their family members. The collected data was difficult to interpret, in part because there are environmental and other factors to take into account, such as race, gender, and the ages of the parents, as well as the mother's exposure to smoking, alcohol, drugs, infections, and other substances that could cause teratogenic effects in the first trimester of pregnancy. Their research revealed that bilateral cleft lip-palate more usually affects the male sex and is more often linked to syndromes or other deformities. In contrast, cleft palate affects women more than men [16].

3. Precision Medicine Approach to Pain and Temporomandibular Disorders

One of the commonly prescribed drugs for pain is under the category of opioids. Examples include tramadol, oxycodone, and codeine. The cytochrome P450 2D6 (CYP2D6) enzyme converts codeine into morphine, whereas tramadol is converted into O-desmethyltramadol, which has a greater affinity for the opioid receptor than its parent molecules [17]. The metabolism of drugs is mostly regulated by particular cytochrome P450 (CYP) isoforms. The occurrence of polymorphisms in these genes is crucial because they can significantly alter enzyme activity, resulting in phenotypes with various metabolic capabilities. Genotyping can therefore shed light on an individual's response to a certain medication, and for some substrates of CYP2C9, CYP2C19, and CYP2D6 isoforms, precision medicine has made individualization of therapy a reality [18].

4. Precision Medicine and Caries and Periodontitis

The microbiota in the human mouth has a substantial impact on oral diseases including dental caries [19]. In a study done by Nadkarni *et al*, using the high-throughput next-generation sequencing technology it was concluded that surface aspects of clinical isolates of *Lactobacillus rhamnosus* enable invasion of tooth pulp. This was possible due to its property to adhere to the cellular and extracellular matrix of the tooth.

Periodontal disease described as one of the most prevalent inflammatory illnesses has a prevalence of 20 to 50% [20]. It covers a wide range of pathological disorders, from mild gingival inflammation to the severe variety [20]. One of the most important causes being accumulation of bacterial infections-bacterial plaque [21]. Ozone therapy is one of the upcoming treatment modalities in relation to various periodontal diseases. Ozone has the property which can lower the microbial load in the context of periodontal illness. It also interferes with regular cellular enzyme activity and lessens its effectiveness. Rapone *et al* concluded double-blind randomized clinical trial and it was seen that in the group treated with ozone in addition to scaling and root planning, there was an improvement in periodontal conditions compared with the group treated with scaling and root planning alone at 3 months [22].

Advantages and disadvantages of PM: (Table 2)

Future Scope

P4 medicine - A number of characteristics help to make care

precise (more effective and efficient, safer), personalized (targeted and individualized), preventative (early intervention, ideally before disease onset), and participatory (including the patient, for example, as data donor or recipient) [23].

Table1: Complexity of cellular functions

Cellular component and others	Definition	Corresponding Omics	Definition
Genome	The complete set of genes in a cell or living thing	Genomics	Analysis of DNA
Transcriptome	The full range of messenger RNA, or mRNA, molecules expressed by an organism.	Transcriptomics	Analysis of messenger RNA
Proteome	The entire complement of proteins that is or can be expressed by a cell, tissue, or organism.	Proteomics	Analysis of proteins
Metabolome	The total number of metabolites present within an organism, cell, or tissue.	Metabolomics	Analysis of metabolites
Epigenome	It consists of chemical compounds that modify, or mark, the genome in a way that tells it what to do, where to do it, and when to do it.	Epigenomics	Analysis of the epigenetic influences of the genome that vary its expression
Microbiome	The combined genetic material of the microorganisms in a particular environment.	Microbiomics	Analysis of eubiotic or dysbiotic environment

Table 2: Advantages and Disadvantages of PM

Advantages of PM	Disadvantages of PM
Reduce the likelihood of therapy side effects.	Cost-prohibitive and not available to everyone concern about data leaks
Knowledge of each patient's or population's specific treatment requirements	It is not feasible financially to target small patient populations
Interpreting genomic data	Unlicensed technology
Enhancing patient care with individualized medication.	Providers of services are uncommon.
For rare and complex diseases, more targeted drug development and higher diagnostic accuracy are needed.	Not every situation ends successfully.
Increasing diagnostic precision	Need to create more tools to analyze the data

Conclusion

To become more relevant, precision dentistry needs to apply cutting-edge clinical trial procedures. In the area of dentistry, PM is moving away from interventional medicine, which can direct the reformulation of treatment protocols and move them steadily more in the direction of a preventive, diagnostic, and therapeutic individualized approach.

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