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Review Article

Breath analysis: An emerging diagnostic approach

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Abstract

On April 14, 2022, to detect COVID-19, breath test was done by Food and Drug administration. It relied on the detection of Volatile Sulfur Compounds (VSC) and utilized a detection device that required a skilled technician to operate. This tool can evaluate one sample in every three minutes with a sensitivity of 91% and specificity of 99%. Amongst others, this screening test can be done at airports also.

To investigate fluid and tissue samples, the disorder is diagnosed via physical, laboratory examination, as well as imaging test.

Keywords: Breathalyzers, Diabetes Mellitus (DM), Hemoglobin**.**

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1. Introduction

For oral diseases, imaging and clinical examination are necessary. For the diagnosis of mucosal lesions, tissue samples are evaluated. For diagnostic relationship to oral diseases, like periodontitis,[1] Gingival crevicular fluid (GCF) as well as saliva samples were analyzed.

For systemic diseases, exhaled breath analysis is also the diagnostic approach. The benefits of using exhaled breath are.[2]

1. Non-invasively and unlimited availability of samples can be collected. A patient breathe 15 times per minute approximately, and which can be changed. As compared to tissue and blood samples, which are invasive, and limited in quantity.
2. For collection, Health care professional is not required, so it is inexpensive.
3. There is no patient discomfort.
4. There is no potentially infectious waste.

Metabolomics is the small molecules study which are the metabolites of tissue with cellular function.[3] Air in exhaled gas of breath contains 21% of oxygen, 80% of nitrogen, and traces of carbon dioxide, water. Exhaled breath has more carbon dioxide (4.5%), identical nitrogen, and less oxygen (16.5 %).

If exhaled breath through oral cavity as compared with the nose, volatile sulfur compounds (VSC) can be added as oral bacterial metabolites.

2. Current Use of Breathalyzer Testing

Alcohol breath test- In the blood, ethyl alcohol concentration can be estimated by the ethyl alcohol concentration in the breath which is exhaled.[4] For over 50 years, this analyzer used to test whether a driver is driving under the ethanol influence or not.

This analyser is available for police use in the field. Ge nerally, these analyzers are based on ethanol consumption w

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hich is eliminated by exhalation and when it get catalyst exposer in the oxygenpresence, ethanol is changed to acetic acid and finally to carbon dioxide and water.

Chemical energy in the form of voltage is released, more the energy, the more will be the absorption of ethanol.[5-7] Detection equipment which is based on Infrared and thus infrared energy absorbed by alcohol.

To assess alcohol content in the blood with a breathalyz er test, an increase in the breath leads to the detection of alc ohol concentration. This is expected because ethanol dissolv es in the blood.

Against this background, the applications of breath anal ysis have expanded to include sports and medical analysis.

3. Nitric Oxide in Asthmatics

Asthma is a type of chronic respiratory disease that can be d ivided into several types based on clinical and clinical featur es.[8] Asthma is distinguished by the cytokines which are inflammatory mediators and interleukins IL 4, IL-5, IL-13.

In this asthma is characterized by eosinophils, which are inflammatory cells similar to neutrophils (characterized by inflammatory diseases in the oral cavity. In inflammation, epithelial cells of bronchial tubes produces nitric oxide (NO) which has helps in respiration.[9] When asthma occurs, there is rise in levels of NO due to the effect of infection on the airways. It is not measurable in emanated breath and risein bronchial diseases. It is considered a risk factor for many oral diseases, especially tooth deca, periodontal disease and candidiasis. This is due to the adverse effects of asthma medications which can cause insufficient saliva production. These medications create an acidic Dodoma in the mouth. People with the most severe asthma are the sickest.[10]

4. Prospective Breathanalyzers Applications for Systemic Diseases

The benefits of breathalyzers to diagnose illnesses, research is investigating the widespread use of breathalyzers in healthcare settings. Conditions considered for respiratory analysis include impaired functions of lung, jaundice (neonatal), rejection of heart transplant, H. pylori infection (linked to stomach ulcers and some carcinomas), liver function,[2] gastroparesis (gastrointestinal),, and diabetes.[11] Diabetes and H. pylori infection are important for dentists.

4.1 Helicobacter pylori detection by breath Analyzers

Helicobacter pylori is the etiology of gastric adenomas, gastric ulcers, and some malignancies, including cancer and non-Hodgkin lymphoma.[12] Although problematic, it is noteworthy that H. pylori detected in the oral cavity and evaluated for the possibility of its return after the infection has been eliminated from the digestive tract. Evidence suggests that oral biofilms may be a H. pylori reservoir and this bacterium in the mouth may prevent its elimination from the stomach. H. pylori infected reservoir is usually confirmed by endoscopy and biopsy, and histology is used to assess the presence of the bacteria. Given the impact of the process, noninvasive tests have been sought, and measurement of breath urea is one such study. Analysis of exhaled radioactive carbon dioxide (here C13O2, a byproduct of urea metabolism) in competition with radioactive urea serves to measure H. pylori infection. Noninvasive H. pylori tests concluded that the H. pylori urea breath test is more precise than stool or blood tests and is cost-effective because of its use of pyrotechnic power. Helicobacter pylori may be detected, the aim is to reduce the burden of these tests and thus make them more effective.

5. Breath Analyzers for Diabetes Mellitus

Diabetes Mellitus (DM) can lead to many medical complications such as retinopathy, kidney disease, cardiovascular disease, and poor healing of wounds. For dentists, diabetes is considered the risk factor for periodontitis with associated other oral changes, like candidiasis, root caries, xerostomia, increased risk of burning sensation. Currently, the level of glucose or glycated hemoglobin is assessed by finger capillary blood test, peripheral blood test. Repeated fingertip testing can be difficult for patients and requires additional monitoring, although continuous glucose monitoring is possible.) concentration is the best marker of metabolic control in diabetic patients. In particular, blood sugar (glucose containing C13) must be taken in the test for analysis, and in the case of diabetes, the C13O2 content is reduced. Other respiratory markers in diabetics have been identified include isopropyl alcohol and acetone.

6. Breath Analyzer Application for Oral Diseases

Breath analyzer has the potential to aid in the determination and assessment of dental
diseases. The mouth is the latest anatomic site to add biomar kers to exhaled air.[14]

Respiratory studies have examined respiratory marker associated with oral squamous cell carcinoma (OSCC, lung cancer.

7. Periodontal Diseases and Breath Analyzer

Bad breath is the common symptom of respiratory oral diseases. Patients often come to the dentist with complaints of bad breath, and determining the associated problems with bad odour can lead to diagnosis and treatment.[15] Measurement. In a clinical examination of the relationship between body odor and bad breath, halitosis was noted to be most prevalent in VSCs, including hydrogen sulfide and methylmercaptan.[16]

Gram-ve microorganisms metabolizes the host cells. Bacteria, epithelial cells, and other saliva accumulate on the

posterior surface of the tongue.[17] Air pollution is considered to have a negative impact on oral health.[18] This relationship analysis showed an odds ratio of 0.51, a 49% decrease in subjective well being in the presence of halitosis.

8. Breath Analyzer and Oral Squamous Cell Cancer

Small Volatile compounds e.g formic acid and ammonia. Low molecular weight biomolecules[19] e.g nucleic acids and peptides. Other Compounds include cytokines and arachidonic acid metabolites given the poor outcomes associated with late diagnosis of OSCC, the use of this method in early diagnosis and treatment evaluation is effective and gaining popularity.

9. Conclusions

Breath analyzers are now used in health of the general population (e.g. alcohol testing) and medicine (e.g. asthma), and the test is prescribed to check for other conditions (e.g. Helicobacter pylori infection, diabetes). Oral antibiotic use is currently being investigated, with an emphasis on diagnosis and treatment of OSCC. Exhaled breath analysis has the advantage of being a simple collection method that allows analysis of many individuals in both nonclinical as well as clinical set ups. Furthermore, these tests may be designed to have a clinical setting (e.g. to be sent to the laboratory or to be used in the patient's bed/chair in the treatment center) or as a screening tool in non-medical settings. It is important for dentists to be aware of the latest developments in diagnostics, including oral diseases.

10. Source of Funding

None.

11. Conflict of Interest

None.

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