

# Biomarkers: A Paradigm Shift In Diagnosis



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## Introduction

Most desirable goal in the health provision is the ability to monitor health status, disease onset and progression, and treatment outcome through non-invasive means. With the progress of health science, the quest for newer, easier and reliable methods to aid in diagnosis, prognosis and treatment plan has been the need of the hour. New diagnostic approaches have replaced their older counterparts, thus overcoming their previous shortcomings. One such approach in dentistry is the emergence of biomarkers. For clinical applications such as monitoring health status, disease onset and progression, and treatment outcome, there are three necessary prerequisites: (i) a simple method for collecting biologic samples, ideally noninvasively; (ii) specific biomarkers associated with health or disease; and (iii) a technology platform to rapidly utilize the biomarkers.<sup>1</sup> Biomarkers of disease in succession play an important role in life sciences and have begun to assume a greater role in diagnosis, monitoring of therapy outcomes, and drug discovery. The challenge for biomarkers is to allow earlier detection of disease evolution and more robust therapy efficacy measurements. This review presents an overview of the value of biomarkers as credible diagnostic tools and the criteria for validation of an ideal biomarker.

## Definition Of Biomarker

"A biomarker or biologic marker is a substance that is objectively measured and evaluated as an indicator of normal biologic processes, pathogenic processes, or pharmacologic responses to a therapeutic intervention".<sup>2</sup>

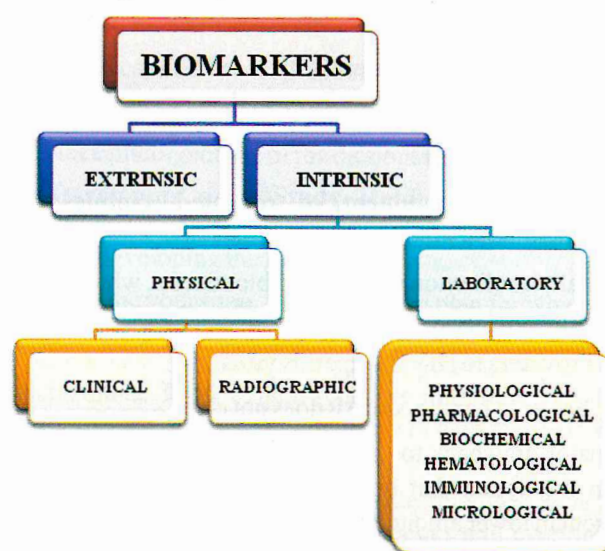
The term biomarker has been in use since long in history of medicine, recently had been replaced by another term "surrogate marker". Till 1993, this term ruled the era, which was ended by the introduction of new term "surrogate endpoint".

A surrogate endpoint has been defined as 'a biomarker intended to substitute for a clinical endpoint'. To go back to the definition of clinical end point, it is defined as 'a characteristic or variable that reflects how a patient feels, functions, or survives'.

## Levels Of Biomarkers

There are many links in the chain of events that leads from the pathogenesis of a disease to its clinical manifestations; biomarkers can be used at any point in the chain, at the molecular, cellular, or organ levels, and clinical level. The ideal biomarker is one through which the disease comes about or through which an intervention alters the disease. From the provided biomarker definition though, it is clear that a biomarker may represent a variety of agents which serve as prognostic or diagnostic indicators of disease or a sensitive and specific tool for risk assessment. Such markers may be biological, physical or molecular in nature

**Types Of Biomarkers That Can Be Used In Diagnosing, Staging, And Monitoring Disease And In Determining Its Response To Therapy.**



(ARONSON JK (2005) Br J Clin Pharmacol: 59(5); 491-494.)

CURTIS(1991) clearly differentiated disease markers as

1. Indicators of current disease
2. Predictors of future disease progression
3. Predictors of future disease at currently healthy sites



## Criteria For An Ideal Biomarker

If a reliable predictive diagnostic test were developed it could predict future periodontal activity and thus enable site specific treatment to be given before irreversible damage has occurred. For this to be the case the marker must have been shown in human longitudinal studies to have highly statistically significant correlations with confirmed attachment loss. It should also be highly predictive and the attachment loss times. A good diagnostic method should have the characteristics of high sensitivity, specificity, and functionality, and meet the requirements of high throughput, portability, and low cost for subsequent clinical application. All these hold good for a biomarker as well.<sup>3</sup>

## Potential Oral Biofluids For Biomarker Analysis

A. Saliva: For the past two decades, salivary diagnostic approaches have been developed to monitor oral diseases such as periodontal diseases and to assess caries risk. Recently, the combination of emerging biotechnologies and salivary diagnostics has extended the range of saliva-based diagnostics from the oral cavity to the whole physiological system. It has various advantages over serum and Gingival crevicular fluid:

- Inexpensive
- Non-invasive
- Easy to collect, store and ship
- Economical
- Patient comfort
- Simple procurement of repeated samples for longitudinal monitoring over time.
- Saliva collection is safer than blood tests, which could expose health care
- Providers to HIV or hepatitis virus.
- Easier to handle, since it does not clot.

A major drawback to use saliva as a diagnostic fluid has been the notion that informative analytes are generally present in lower amounts in saliva than in serum.<sup>4</sup>

## B. Gingival Crevicular Fluid

GCF contains a wide range of cellular and biochemical molecules associated with disease activity. It has certain advantages like: its noninvasiveness, site specificity about teeth, comparatively easy to collect and presents one of the most accessible entrees to any tissue in the body as channel of evaluating the disease state. In addition, it is an inflammatory exudate that indicates ongoing events in the periodontal tissues that produce it. Disadvantages include,

that it is, Nonaccurate and nonreproducible; No uniform consensus on choice of collection device; its placement and collection time; Potential depletion of sample by prolonged collection; Potential contamination by serum components and loss of sample from the collection device; Variability in calculation of data as absolute measures or as flow rates.<sup>5</sup>

## Summary And Conclusion

The search for useful biomarkers is a constant one. It is unfortunate that till date no single biomarker exists with respect to oral diseases which fulfill all the criteria for an ideal biomarker. It is imperative that all proposed biomarkers, regardless of intent or nature, demonstrate their utility by both providing a strong biological rationale for investigation and undergoing a rigorous demonstration of the sensitive, selective, accurate and precise assessment of the outcome for which they are proposed to measure. It can be inferred from the foregoing that new technologies have been developed or are in development that could be used to enhance the ability to predict, diagnose, and treat oral diseases. Not all of these technologies will bear fruit; however, those that do will provide clinicians of the twenty first century with more effective means of detection, prevention and treatment of oral diseases than are currently available.

## References

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