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Periondontal Applications of Saliva and Gingival Crevicular Fluid as a Diagnostic Tool

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Abstract:- Saliva as a diagnostic fluid offers distinctive advantages over serum because it is collected non-invasively by individuals with modest training. furthermore, saliva may provide an economical approach for the screening of huge populations. whole saliva could also be used for diagnosis of systemic diseases, because it contains serum constituents. Early detection plays a crucial role in its prevention and progression. saliva may be a reliable medium that mirrors periodontal health and is easily obtainable for identifying periodontal biomarkers in point-of-care diagnostics. This article review explains the periondontal applications of saliva and gingival crevicular fluid as a diagnostic tool. In future we are likely to ascertain the increased utilization of saliva as a diagnostic fluid.

Keywords:- *Saliva; GCF; Periodontolog.*

I. INTRODUCTION

Salivary diagnostics holds great promise as an effective method for the early diagnosis, prediction, and monitoring post-therapy status. Whole saliva is a mixture of the secretions from the major and minor salivary glands, mucosal transudations, gingival crevicular fluid, serum and blood derivatives from oral wounds, desquamated epithelial cells, expectorated bronchial and nasal secretions, along with bacteria and bacterial products, viruses and fungi, Other cellular components, and food debris.(1) . In humans, saliva is 98% water plus electrolytes, mucus, white blood cells, epithelial cells, enzymes (such as amylase and lipase), antimicrobial agents such as secretory IgA, and lysozymes.

Saliva performs various functions like buffering, remineralization, lubrication, and digestion. It also prevents demineralisation and protects against microorganisms. (2)

A gingival crevicular fluid contains all the molecular (complement components and antibodies) and cellular (neutrophils and plasma cells) components of the immune response required to create barrier for subgingival plaque bacteria from invading the tissues. In periodontitis, the collection and analysis of gingival crevicular fluid has long been popular as a method of investigating localized inflammatory processes; Barros et al described gingival crevicular fluid formation and dynamics, as well as how gingival crevicular fluid can be analyzed for periodontal disease biomarkers (3).

Periodontitis is defined as chronic condition with gingival inflammation, periodontal ligament destruction, and alveolar bone resorption as basic characteristics. After a periodontal examination, diagnosis of periodontal disease is made. Conventional periodontal differentiating clinical parameters include probing depths, bleeding on probing, clinical attachment levels, Plaque index and radiographs for alveolar bone position assessement. (4)

II. ADVANTAGES (5)

- It has true - time diagnostic values.
- Ease and safety of attaining multiple samples.
- Collection and observing may be done at home.
- It'snon-invasive, easy and affordable.
- It has lowest threat of cross - infection.

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- Further economizing sampling, shipping and storing.
- Manipulation needed during diagnostic procedures.
- Is less as compared to that for serum.
- There's the marketable accessibility of screening assay.
- Saliva doesn't clot unlike blood.

III. LIMITATIONS (5)

- The levels of these markers in serum cannot be reflected by the concentration levels in saliva.
- Salivary composition are oftentimes affected by the approach of collection and magnitude of stimulation of salivary flow.
- Changes in salivary flow may affect the dilution of salivary markers and also their obtainability because of changes in salivary pH.
- Variability in salivary flow is anticipated between different individuals and within the same individual under unlike conditions.
- Numerous serum markers can be found in whole saliva in hit or miss way (i.e., GCF flow and exudates fromoral lacerations). These factors will affect the diagnostic utility of numerous salivary components.
- likewise, certain systemic diseases, multiple medicines and radiation may affect salivary gland function and accordingly the quantity and composition of saliva.
- Whole saliva also consists of proteolytic enzymes from the host and oral microorganisms collectively. These enzymes can affect the stability of certain diagnostic markers and some parts are degraded during intracellular diffusion into saliva.

IV. GENOMIC ANALYSIS

Salivary genetic and epigenetic analysis provides perception into the presence of raiding pathogens, and profiles of aberrant gene transcription that directly indicates pathological genetic processes. DNAs representing the genome of the host, oral microbiota and infecting DNA contagions constitutes the salivary genome.

V. PROTEOMIC ANALYSIS

There are over 1,166 proteins in the salivary proteome, the majority of which are synthesized and then introduced into the oral cavity by the salivary acinar cells. It can be reflective of both local and distant disorders.

It is noteworthy that the presence of these salivary proteomic markers even at low concentrations plays a critical role in the diagnosis of disorders. In the early stages of a disease, salivary proteome analysis may be able to reveal morbidity flags and monitor the progression of the disease.

VI. TRANSCRIPTOMIC ANALYSIS

As a major source of diagnostic information with a very specific discriminatory indicator, the transcriptome consists of coding RNAs (mRNAs) and noncoding RNAs (miRNAs, little nuclear RNAs, small nucleolar RNAs). Both miRNAs and total RNA can be found in saliva supernatant and whole saliva.(5)

The idea of periodontal diagnostic operations is to procure useful information regarding the current periodontal disease type, location, and severity to the clinician which functions a basis for treatment planning and give essential data during periodontal maintenance and disease- monitoring phases of treatment. Traditional diagnostic procedures are innately limited in assessment of only the disease history and notn providing the current disease status, . Advancements in diagnostic research in oral and periodontal disease are moving towards techniques where associated periodontal risk is assessed and quantified by objective measures(e.g., biomarkers).(7). Salivary enzyme markers like Aspartate Transaminase, Alkaline Phosphatase are elevated in chronic periodontal complications whereas Lactoferrin and Nitric oxide are found to be increased in Aggressive periodontal diseases.

Several biomarkers are illustrated in Table 1 and Table 2.

Table 1:Enzyme markers in saliva. (8)

MARKERS	PERIODONTAL DISEASES	PATHOGENESIS
AST	Periodontitis	Increased level of AST in tissues -> Salivary Gland -> Saliva -> GCF
Alkaline phosphatase	Chronic periodontitis	
Proteinases	Aggressive and chronic periodontitis	Increased inflammation ->Neutrophils -> Increased secretion
Lactoferrin	Aggressive periodontitis	Lactoferrin is an iron binding enzyme. As iron saturation decreases the amount of lactoferrin increases in saliva. It inhibits microbial growth
Active MMP8	Aggressive + chronic periodontitis and peri-implantitis	They are host proteinases responsible for both tissue degradation and remodeling. During progressive

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		periodontal breakdown, gingival and periodontal ligament collagens are cleaved by host cell–derived interstitial collagenases
Chitinase and Hexosaminase	Aggressive and Chronic periodontitis	Secreted by the phagocytic cells. Increased levels are seen in Periodontal inflammation.
Nitric Oxide	Gingivitis and Aggressive Periodontitis	Its production is controlled by reciprocal countercurrent interaction of NO synthase and arginase.
C-Reactive Protein (CRP).	Chronic and aggressive periodontitis	The levels of CRP in plasma and saliva correlate. Their levels increase subsequently with the severity of the periodontal disease.
Microbiological load	Chronic and aggressive periodontitis	Aggregatibacter actinomycetemcomitans, Filifactor alocis, P. gingivalis, Prevotella intermedia, Tannerella forsythia, Treponema denticola are seen in small quantities.

Table 2: Protein markers in saliva. (8)

PROTEIN MARKERS	PATHOGENESIS
Cystatins	These decrease in sulcular fluid and saliva during periodontitis, ultimately leading to tissue damage by cathepsins.
Neopterin	Neopterin is a cytokine produced by macrophages that participates in the formation of nitric oxide radical which is important for phagocytosis
Fibronectin	Decreased levels are seen. Fibronectin blocks adhesins of many periodontal microorganisms, reducing their adherence to periodontal tissues.
Cytokines	Increased levels vascular endothelial growth factor, and hepatocyte growth factor, of platelet-activating factor, Salivary interleukin-1 beta, tumor necrosis factor-alpha are seen in periodontal inflammation

VII. PERIODONTAL MARKERS IN PREGNANCY

In a study done by Pınar Gümüş et al in 187 women during pregnancy and postpartum period and non- pregnant healthy women, oxidative stress markers, 8-hydroxy-2'-deoxyguanosine (8-OhdG) and of glutathione peroxidase (GPx) showed significantly elevated and reduced levels respectively in pregnant women whereas the levels thiobarbituric acid-reactive substances (TBARS) correlated with that of non- pregnant women. (9)

In another study, done by Manar N. Hassan et al involved measurement of the levels of ANXA1 and IL-1β , it was found that salivary ANXA1 levels are significantly higher in gingivitis during pregnancyin comparison to general healthy individidual as well as non pregnant women.(10)

It is reported that higher levels of cytokine pro-inflammatory such as TNF-α interleukin 1 beta (IL-1β) are found in gingival crevicular fluid in pregnant women as compared to non-pregnant women indicating higher relevance of role of cytokines in oral fluid in gingivitis during pregnancy. Additionally, pregnant women show a significant decline in gingival crevicular fluid levels of IL-1β three months postpartum.(11)

VIII. CONCLUSION

It has the potential to become the future in early detection due to its importance in biological research and applications. Saliva is a major biological fluid with a wide range of research and applications. Saliva has become an attractive alternative to other more invasive diagnostic methods due to the effective contribution of genomics and proteomics. This review has discussed several biomarkers whose salivary and GCF levels correlate with the inflammation in the periodontium, that could help dentists to understand the progression and prognosis of a periodontal disease before and after treatment. In order for saliva to become a reliable and effective diagnostic tool, more research will be needed.

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