IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 5 Ser. 1 (May. 2025), PP 42-49
www.iosrjournals.org

A Review On Chairside Diagnostic Test In Periodontics

Author

Date of Submission: 24-04-2025 Date of Acceptance: 04-05-2025

I. Introduction

Periodontal diseases are a group of chronic inflammatory conditions affecting the supporting structures of teeth, including the gingiva, periodontal ligament, cementum, and alveolar bone. The primary cause is microbial dysbiosis within dental plaque, which triggers an immune response leading to progressive tissue destruction. With nearly half of the global adult population affected, periodontal diseases pose a significant threat due to their potential to cause tooth loss and contribute to systemic conditions like cardiovascular disease and diabetes.

Traditional diagnostic methods rely on clinical examination and radiographic evaluation, assessing parameters such as probing pocket depth (PPD), clinical attachment loss (CAL), and bleeding on probing (BOP). However, these approaches often detect periodontal disease at later stages, when irreversible tissue damage has already occurred. (1)

Recently, there has been an increasing focus on developing earlier and more precise diagnostic techniques to identify active disease processes before significant tissue destruction occurs. The introduction of chairside diagnostic tools has transformed periodontal care by enabling real-time, molecular-level insights into the disease status. These innovative methods, such as enzymatic assays, immunological markers, and advanced molecular techniques like Polymerase Chain Reaction (PCR), provide non-invasive, rapid, and accurate assessments of periodontal health. This review explores the current landscape of chairside diagnostic techniques in periodontics, their clinical applications, and their potential to enhance periodontal diagnosis and treatment planning

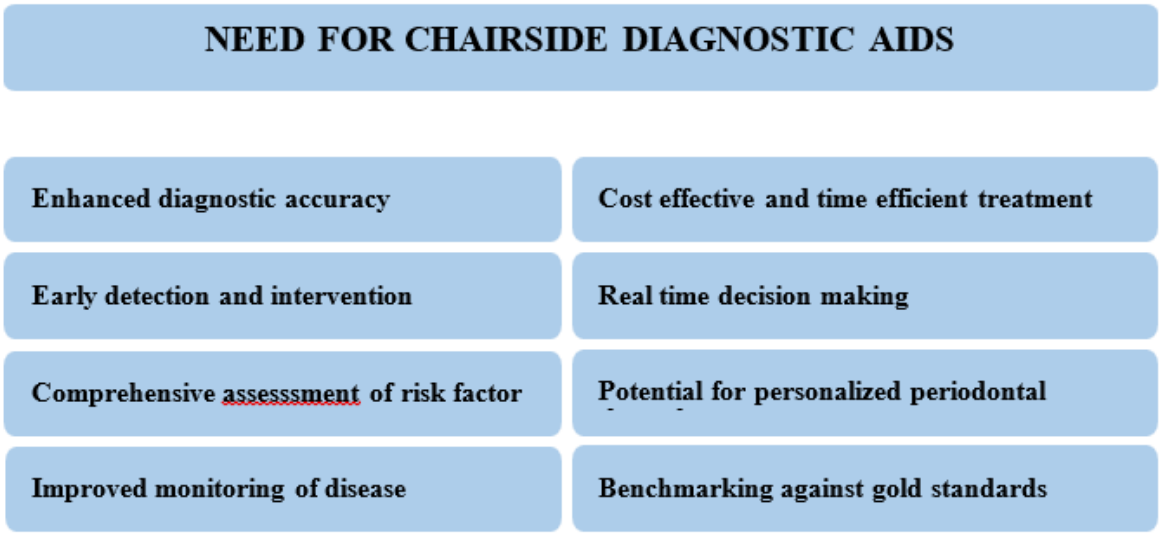
II. DIAGNOSIS: The Crucial Role In Periodontics

Accurate diagnosis is fundamental in managing periodontitis, as it enables the early detection and identification of active disease processes. Given that periodontal diseases are complex and multifactorial, a precise diagnosis helps uncover the underlying microbial and host-related factors driving tissue destruction. This understanding is critical for developing a targeted treatment plan, monitoring the progression of the disease, and evaluating the response to therapy. Early and accurate diagnosis not only improves the chances of successful treatment but also helps prevent severe complications and potential systemic health issues associated with advanced periodontal disease

III. Features Of Ideal Diagnostic Test Kit

For periodontal diagnosis, the ideal diagnostic test should be [2]:

1. Quantitative.
2. Highly sensitive method capable of analysing a single periodontal site in health as well as disease.
3. Reproducible.
4. Highly specific.
5. Simple to perform.
6. A rapid, one or two stage procedure.
7. Non-invasive.
8. Versatile in terms of sample handling, storage and transport.
9. Amendable to chair side use.
10. Economical.
11. Dependent upon simple and robust instrumentation.



1. Enhanced Diagnostic Accuracy

- Chairside diagnostic tools enable the detection of active periodontal disease, providing real-time information on the current state of disease activity rather than solely relying on evidence of past destruction (such as clinical attachment loss and radiographic bone loss). This allows for a more accurate assessment of the patient's periodontal condition, which is crucial for effective treatment planning.[1]

2. Early Detection and Intervention

- Traditional diagnostic methods focus on detecting irreversible tissue destruction, often identifying the disease at advanced stages. Chairside diagnostic kits offer a significant advantage by allowing the early detection of active disease processes. This early diagnosis facilitates timely intervention, reducing the severity of the disease and potentially preventing extensive tissue damage.

3. Comprehensive Assessment of Risk Factors

- Periodontal diseases are multifactorial, influenced by microbial, immunological, systemic, genetic, and behavioral factors. Chairside tests can assess various host and bacterial markers, offering insights into the underlying cause of the disease and the patient's susceptibility. This comprehensive evaluation aids clinicians in identifying at-risk patients and customizing treatment strategies based on individual risk profiles.

4. Improved Monitoring of Disease Progression

- Conventional diagnostic methods do not provide information about the current activity of the disease or its progression over time. Chairside diagnostic tests enable clinicians to monitor specific biomarkers related to inflammation and tissue breakdown. This monitoring helps determine whether the disease is in an active phase, remission, or responding positively to therapy, allowing for adjustments in the treatment plan as needed.

5. Cost-Effective and Time-Efficient Treatment Planning

- The ability to diagnose active periodontal disease early on can lead to less invasive and time-consuming treatment approaches. This reduces overall treatment costs and enhances patient compliance. By preventing extensive periodontal damage, chairside diagnostic tools contribute to better long-term prognoses and lower healthcare expenses for patients.

6. Real-Time Decision-Making

- Chairside tests provide immediate results, which are valuable in clinical settings where timely decision-making is critical. This rapid feedback enables dentists to make on-the-spot treatment decisions, improving the efficiency of periodontal care and enhancing patient outcomes.

7. Potential for Personalized Periodontal Therapy

- By identifying specific biomarkers and indicators of disease activity, chairside diagnostics pave the way for personalized periodontal therapy. Clinicians can tailor treatment plans based on individual patient profiles, targeting specific microbial or host factors that contribute to the disease, leading to more effective and customized treatment outcomes.

8. Benchmarking Against Gold Standards

- The validation of chairside diagnostic tests against established gold standards, such as alveolar bone levels and clinical attachment levels, ensures their reliability and effectiveness. As these new diagnostic tools continue to be evaluated, they have the potential to complement traditional methods and enhance the overall accuracy of periodontal diagnosis.

IV. Comparison Between Conventional And Advanced Diagnostic Probe

Parameter	Conventional diagnostic	Advanced diagnostic
Diagnostic Tools	Periodontal probe Explorer Dental mirror	Electronic probes, digital scanners, molecular diagnostic kits (e.g., DNA tests, chairside ELISA kits)[3]
Assessment Method	Manual probing and clinical inspection	Automated digital measurements, real-time biochemical analysis
Measurement Parameters	Probing pocket depth (PPD), clinical attachment level (CAL), gingival bleeding on probing (BOP) [4]	PPD, CAL, BOP, quantitative analysis of periopathogenic bacteria, biomarkers like IL-1, MMPs [5]
Accuracy and Reliability	Operator-dependent; influenced by probing force and angulation	High reproducibility and precision with reduced operator variability
Detection of Pathogens	Visual assessment, clinical signs, no specific pathogen detection [6]	Detected with the data available
Time Efficiency	Time-consuming; requires assessment of individual sites manually	Faster with automated data collection and immediate digital output
Patient Comfort	Can be uncomfortable or painful, especially with inflamed tissues	Generally, more comfortable, less invasive probing
Diagnostic Capability	Primarily evaluates clinical signs (e.g., PPD, CAL)	Additional information can be obtained
Clinical Usefulness	Useful for initial diagnosis and routine follow-up	Superior for early detection, monitoring treatment response, and personalized therapy planning
Cost and Accessibility	Lower cost, widely available	Higher cost, may not be available in all clinical settings

DIAGNOSTIC AIDS

1. CONVENTIONAL
a. CLINICAL
b. RADIOGRAPHS
2. BIOMARKERS
a. Microbiological kits
b. Biochemical kits
c. Genetic kits

CHAIRSIDE KIT

- Microbiological kits

1. EVALUSITE
2. PERIOSCAN
3. OMNIGENE
4. IAI PADO TEST
5. My Perio path
6. DNA probes

- Biochemical kits

1. Perio-check (Ac Tech)
2. Prognos- stik (Dentsply)
3. PerioGard
4. PerioWatch
5. Perio2000
6. Dips tick test
7. TOPAS (Toxicity pre-screening Assay)
8. Intergrated micfofluid platform for oral diagnostics
9. Oral fluid nano sensor test (OFNASET)
10. ELECTRONIC TASTE CHIPS [7-21]

- Genetic kits

1. My perio ID

V. Microbiological Kits:

EVALUSITE

The Evalusite Test, developed by Eastman Kodak Company, is a polyclonal antibody-based sandwich enzyme immunoassay designed to detect key periodontal pathogens. It targets specific antigens of Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis, and Prevotella intermedia in subgingival samples collected using paper points. The test is particularly effective for simultaneous analysis of multiple samples, as placing multiple paper points in one sample tube results in minimal dilution.[7]

Composition :The Evalusite test uses polyclonal antibodies in a sandwich enzyme immunoassay format, allowing for the visual detection of bacterial antigens. To perform the test, paper points are inserted into periodontal pockets to collect subgingival plaque samples. These samples are then placed in a reaction tube containing specific reagents. A color change indicates the presence of target bacteria, with deeper periodontal pockets showing a higher likelihood of positive detection.[8]

Procedure: To perform the test, paper points are inserted into periodontal pockets to collect subgingival plaque samples. These samples are then placed in a reaction tube containing specific reagents. A color change indicates the presence of target bacteria, with deeper periodontal pockets showing a higher likelihood of positive detection.

Diagnostic Uses: The Evalusite test helps in identifying the presence of key periodontal pathogens, assisting clinicians in diagnosing and managing periodontitis by confirming bacterial colonization in subgingival pockets. However, it has certain limitations, such as being a multistage procedure with a subjective colorimetric endpoint. Additionally, the test assumes the involvement of the three specified bacteria in the disease process without offering a permanent record of the results.

Sensitivity and Specificity: The Evalusite test demonstrated varying levels of diagnostic accuracy, with a sensitivity of 28% and specificity of 98% for A. actinomycetemcomitans, and a sensitivity of 52% and specificity of 98% for P. gingivalis. Despite its high specificity, the relatively low sensitivity suggests it may miss some cases, particularly in the early stages of bacterial colonization. [9]

PERIOSCAN

Perioscan utilizes the BANA (N-benzoyl-DL-arginine-2-naphthylamide) principle to detect specific periodontal pathogens, such as Treponema denticola, Tannerella forsythia, and certain Capnocytophaga species. These bacteria are known to produce trypsin-like proteases, which are targeted by this diagnostic method. [10]

Procedure

1. Sample Collection: Subgingival plaque is collected using a sterile curette.
2. Application: The collected plaque sample is placed onto a plastic strip containing the BANA substrate.
3. Incubation: A parallel strip with Evans black dye is dampened and folded to come in contact with the BANA strip. This setup is incubated for 15 minutes at 55°C.
4. Result Interpretation: After incubation, the strips are unfolded. The presence of a blue color on the dye strip indicates the hydrolysis of the BANA substrate, suggesting the presence of trypsin-like enzymes from the targeted bacteria.[11]

Advantages

- Simple and User-Friendly: The test is straightforward and easy to interpret.
- High Sensitivity: Effective in detecting specific enzyme-producing periodontal pathogens.

Limitations

- Lower Reproducibility: The results are subjective and rely on the operator's assessment of the color change, which may lead to variability in the outcomes.[12]

Overall, Perioscan provides a rapid, chairside method for detecting specific periodontal pathogens, enhancing the early diagnosis and management of periodontal disease.[13]

OMNIGENE

Omnigene: A Genetic Nucleic Acid Probe for Periodontal Pathogens

Composition and Methodology: Omnigene is a genetic nucleic acid probe that utilizes purified DNA fragments to identify specific periodontal pathogens, including P. gingivalis and P. intermedia. It initially faced limitations in detecting A. actinomycetemcomitans but has been expanded to target eight key periodontal pathogens (P. gingivalis, P. intermedia, A. actinomycetemcomitans, F. nucleatum, E. corrodens, C. rectus, T. forsythia, and T. denticola). The detection is based on species-specific DNA probe tests designed using principles of genetic engineering.[14]

Procedure: Subgingival plaque samples are collected from patients using standardized collection methods. The samples are then mailed to a laboratory for analysis. Results are communicated back to the practitioner via phone, fax, or mail, providing a detailed pathogen profile that assists in diagnosing periodontal conditions.[15]
Diagnostic Application: Omnigene allows for a comprehensive genetic analysis of the subgingival microbiome, offering detailed insights into the bacterial composition associated with periodontal diseases. However, studies have noted potential false negatives, particularly in detecting P. gingivalis. [16]

Performance:
- Sensitivity for A. actinomycetemcomitans: 21% (clinical samples), 96% (laboratory samples)
- Specificity for A. actinomycetemcomitans: 83%
- Sensitivity for P. gingivalis: 71% (clinical samples), 60% (laboratory samples)
- Specificity for P. gingivalis: 53% (clinical samples), 82% (laboratory samples)

Omnigene has also been adapted for non-periodontal applications, including the collection of COVID-19 saliva samples under the FDA's Emergency Use Authorization, demonstrating its versatility in clinical diagnostics.

IAI PADO TEST: Institute for Applied Immunology (IAI) PADO Test

The PADO Test 4.5 is an RNA probe-based diagnostic tool designed to detect four key periodontal pathogens: Aggregatibacter actinomycetemcomitans (Aa), Porphyromonas gingivalis (Pg), Tannerella forsythia (Tf), and Treponema denticola (Td). It employs oligonucleotide probes that are complementary to conserved regions of the 16S ribosomal RNA (rRNA) gene, which is a fundamental component of the bacterial ribosome.[17]

Composition and Procedure: The assay uses specific RNA probes to target and encrypt the rRNA of these pathogens. Subgingival plaque samples are collected from periodontal pockets, and the RNA is extracted and hybridized with oligonucleotide probes that match conserved sequences of the 16S rRNA. The detection threshold is set at 10310^3103 for A. actinomycetemcomitans and 10410^4104 for P. gingivalis, T. forsythia, and T. denticola. The results are obtained by measuring the hybridization signals, indicating the presence of these bacteria.[18]

Efficacy and Limitations: A study by Leonhardt A et al. comparing the PADO Test 4.5 with the Checkerboard DNA-DNA hybridization method found that the PADO Test detected the target pathogens in only 36.6% of chronic periodontitis cases, while the Checkerboard method identified them in all patients. This discrepancy highlights the PADO Test's lower sensitivity, which is attributed to a high rate of false negatives. Consequently, the test may underestimate the presence of pathogenic bacteria, particularly in cases with low bacterial loads. [38]. Despite its innovative approach, the PADO Test 4.5 is limited by its low sensitivity and potential underestimation of bacterial prevalence, making it less reliable for detecting periodontal pathogens compared to more comprehensive methods like Checkerboard DNA-DNA hybridization.[19] Future improvements in probe design and sensitivity are needed to enhance its diagnostic accuracy.

MY PERIOPATH

My PerioPath is a diagnostic test that analyzes saliva samples to identify and quantify periodontal pathogens responsible for oral infections. It provides an early detection tool for active periodontal disease, enabling personalized periodontal therapy based on the bacterial profile of an individual.[20]

Composition and Procedure: The test involves collecting a saliva sample, which is then sent to a specialized laboratory for analysis. It employs DNA probe technology to identify high, moderate, and low-risk periodontal pathogens. High-risk bacteria detected include Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis, Tannerella forsythia, and Treponema denticola. Moderate-risk pathogens such as Eubacterium nodatum, Fusobacterium nucleatum, Prevotella intermedia, Campylobacter rectus, and Parvimonas micros are also identified, along with low-risk pathogens like Eikenella corrodens and Capnocytophaga sputigena. [21]

Merits of DNA Probes:
- High specificity and sensitivity in detecting phenotypic markers.
- Unaffected by transport conditions and do not require anaerobic conditions.
- Effective in detecting both viable and non-viable bacteria.[22]

Demerits:
- The test is costly and cannot be conducted chairside, requiring lab analysis.

- Detection limits range from 10310^3103 to 10510^5105 bacterial cells, potentially missing lower levels of infection.
- Possible cross-reactivity with oligonucleotide probes.
- Does not provide information on antibiotic sensitivity.

My PerioPath offers a comprehensive bacterial analysis, allowing for targeted periodontal treatment. However, its reliance on lab-based analysis and high costs can limit its accessibility for immediate chairside diagnosis.

DNA PROBES:

DNA probe technology is a modern and highly specific method for detecting periodontal pathogens by targeting unique nucleic acid sequences. This technique is based on the use of enzyme-digested DNA fragments that represent specific bacterial species, allowing for precise identification of pathogens even in complex microbial environments. DNA probes can detect a wide range of bacteria, making them a powerful tool for diagnosing periodontal infections. This approach is not only sensitive but also enables the identification of multiple species in a single examination, with a detection limit as low as 10410^4104 cells. [23]

Merits of DNA Probes:

- **High Specificity and Sensitivity:** DNA probes can accurately identify phenotypic markers of bacteria, making them highly reliable for detecting periodontal pathogens like A. actinomycetemcomitans, T. forsythia, P. intermedia, and T. denticola. [24]
- **No Need for Anaerobic Conditions:** The test does not require maintaining anaerobic environments, which is advantageous in clinical settings.
- **Effective in Non-Viable Bacteria:** DNA probes can detect bacterial DNA even in dead bacteria, allowing for the detection of pathogens regardless of their viability.
- **Rapid Results:** DNA probe tests can identify pathogens in less than 40 minutes, offering timely insights into the presence of periodontal infections.

Demerits of DNA Probes:

- **Cost:** DNA probe testing is expensive, which may limit its widespread use, particularly for routine diagnosis.
- **Detection Limits:** The test can only detect bacteria at levels of 10310^3103 to 10510^5105 cells, which means lower bacterial loads might go undetected.
- **Not for Chairside Use:** DNA probe testing requires laboratory-based analysis, meaning it cannot be performed during a routine dental visit.
- **Cross-Reactivity:** There is a potential for cross-reactivity by oligonucleotide probes, which can lead to inaccurate results.
- **No Antibiotic Sensitivity Testing:** DNA probes do not provide information on the antibiotic susceptibility of the detected pathogens.[25]

Applications in Periodontal Diagnosis: DNA probes are particularly useful for the early detection and monitoring of periodontal infections. They can track the levels of specific pathogens before and after treatment, providing valuable data on the success of therapies aimed at reducing subgingival bacterial infections. Additionally, DNA probes help assess the microbial profile throughout the treatment process, contributing to personalized treatment plans. However, their application is limited to the pathogens for which the probes are specifically developed.

DNA probe technology offers a more sensitive and accurate method for detecting periodontal pathogens. While it is not suitable for chairside use due to its cost and need for laboratory processing, it remains an invaluable tool for specialized and advanced periodontal diagnostics. [26]

BIOCHEMICAL KITS:

Test Name	Detection Target	Sample Collection	Principle	Advantages	Limitations
Perio-Check (Ac Tech)	Neutral proteases (MMPs, collagenases)	GCF strip	Measures enzyme activity by dye release from collagen-dye complex on GCF strip, turning it blue	Rapid chairside test, FDA-approved	Saliva contamination, not specific for PMN collagenase
Biolise	Elastase activity in GCF	GCF	Detects elastase activity using enzyme-substrate reaction	Sensitive to elastase activity	Limited by sample contamination

Prognos-Stik (Dentsply)	Elastases in GCF	GCF strip	Uses fluorescent indicator substrate cleaved by elastase, visible under fluorescent light	Rapid detection of elastase	Requires further clinical trials for validation
PerioGard	Aspartate aminotransferase (AST) in GCF	GCF strip	Measures AST activity through enzyme reaction producing color change; linked with tissue destruction	Monitors disease activity and treatment response	Cannot distinguish between severe inflammation without attachment loss and sites with attachment loss
PerioWatch	Aspartate aminotransferase (AST)	GCF	Uses pyridoxal phosphate for AST reaction, indicating disease activity by color change	Differentiates active from inactive disease sites	Influence of extracellular matrix components
Perio2000 System	Volatile sulfur compounds (VSCs)	GCF, probe tip	Detects VSCs using a microsensor in periodontal probe, indicating bacterial activity	Combines probing and microbial assessment	Cost, need for disposable sensor tips
MMP-8 Dipstick Test	Matrix metalloproteinase-8 (MMP-8)	GCF strip	Immunochromatography using two monoclonal antibodies; visual line formation if MMP-8 present	Quick detection, differentiates healthy vs compromised sites	Limited sensitivity in small volume samples
TOPAS	Bacterial toxins and proteins	GCF	Detects markers of infection (toxins/proteins) related to inflammation severity	Assesses inflammation and disease evolution	Cannot identify specific bacterial pathogens
Oral Fluid Nano Sensor Test (OFNASET)	Salivary protein and RNA biomarkers	Saliva	Uses electrochemical detection for real-time multiplex analysis of biomarkers	High sensitivity and specificity, non-invasive	High cost, requires specialized equipment

GENETICS:

My perio ID: MyPerioID identifies the genetic susceptibility of the patient to periodontal diseases by using salivary samples which are shipped to the laboratory for the results. These test plays role in evaluating the patients which are at higher risk of periodontal destruction [27]

IMPOD: Integrated Microfluidic Platform for Oral Diagnostics (IMPOD)

A clinical point-of-care diagnostic test that involves a monolithic disposable cartridge designed to perform in a compact analytical equipment to identify an oral disease biomarker in human saliva. To evaluate analyte concentrations in pre-treated saliva samples, it incorporates sample pre-treatment (filtering, enrichment, and mixing) alongside electrophoretic immunoassays. Photoinitiated polymerisation is employed to coat the channel surfaces with the help of linear polyacrylamide that undergoes cross-linking in-situ [28]. It rapidly measures MMP-8, IL-6, TNF-α in saliva from healthy and periodontally diseased subjects . In IMPOD, off-chip sample intubation and reporter binding steps can be discarded since the analyte trapping happens in the volume near the membrane [29]. More research into the recognition and confirmation of these biomarkers is currently underway.

VI. Conclusion

Chairside diagnostic aids hold significant promise for enhancing periodontal care by providing rapid, reproducible results that support accurate diagnosis, effective treatment planning, and patient motivation. Their ability to identify active disease sites and monitor post-treatment responses offers a valuable tool for evaluating therapy outcomes and detecting disease recurrence. However, due to the variability in subgingival microflora and pathogenic microorganisms between individuals and specific sites, personalized treatment approaches remain essential. Continued research and advancements in these diagnostic methods are crucial to ensure their reliability and integration into routine clinical practice, ultimately contributing to more effective and targeted periodontal therapies.Periodontitis management efficiency depends on the effective diagnostic measures taken by the periodontist.(30)

“Diagnosis is not the end, but the beginning of practice”-Martin H Fischer

Reference:

[1] Research By L.C. Giannobile Or H.L. Kornman On Biomarkers And Diagnostics In Periodontology.
[2] Chapple IL. Periodontal Diagnosis And Treatment-Where Does The Future Lie? Periodontol 2009; 51:9-24.
[3] Chen C And Slots J. Microbiological Tests For Actinobacillus Actinomycetemcomitans And Porphyrornonas Gingivalis. Periodontol 1999; 20:53-64.
[4] Boyer BP, Ryerson CC, Reynolds HS, Zamhon JJ, Genco RJ, Snyder B. Colonization By Actinohacillus

[5] Actinomycetemcomitans, Porphyromonas Gingivalis And Prevotella Intermedia In Adult Periodontitis Patients As Detected By The Antihody-Based Evalusite Test. J Clin Periodontol 1996; 23:477-484.
[6] Malathi K, Sharmila K, Sable D, Ahamed S. Microbial Diagnosis In Periodontics: Merits And Demerits: A Review. J Dent Med Sci 2014; 13(2):104-107.
[7] Hemmings KW, Griffiths GS, Bulman JS. Detection Of Neutral Protease (Periocheck) And BANA Hydrolase (Perioscan) Compared With Traditional Clinical Methods Of Diagnosis And Monitoring Of Chronic Inflammatory Periodontal Disease. J Clin Periodontol 1997; 24:110-114.
[8] Van Steenbergen TJM, Timmerman MF, Mikx FHM, De Quincey G, Van Der Weijden GA. Van Der Velden U, De Graaf J. Discrepancy Between Culture And DNA Probe Analysis For The Detection Of Periodontal Bacteria. J Clin Periodontol 1996; 23:955-959.
[9] Van Arsdell SW, Difronzo F, Backman KC, Mahler PH. Selling Biotechnology In [17]The Dental Medicine Marketplace: The Omnigene Diagnostics DNA Probe Tests For Periodontal Pathogens. Technol Health Care. 1996;4(3):339-46.
[10] Https://Www.Fda.Gov/Media/143419/Download Omnigene·ORAL-US Food And [19]Drug Administration.
[11] Cosgarea R, Bäumer A, Pretzl B, Zehaczek S, Kim TS. Comparison Of Two [29]Different Microbiological Test Kits For Detection Of Periodontal Pathogens. Acta Odontol Scand. 2010;68(2):115-21.
[12] Paster BJ, Dewhirst FE. Molecular Microbial Diagnosis. Periodontol 2000. [30]2009;51:38-44.
[13] Leonhardt A, Carlén A, Bengtsson L, Dahlén G. Detection Of Periodontal Markers [31]In Chronic Periodontitis. Open Dent J. 2011;5:110-15.
[14] Leonhardt A, Carlen A, Dahlen G. Detection Of Periodontal Markers In Chronic Periodontitis. Open Dent J 2011; 5: 110-115.
[15] Leonhardt A, Carlén A, Bengtsson L, Dahlén G. Detection Of Periodontal Markers In Chronicperiodontitis Open Dent J. 2011;5:110–5
[16] Bernardi S, Karygianni L, Filippi A, Anderson AC, Zürcher A, Hellwig E, [14]Et Al. Combining Culture And Culture-Independent Methods Reveals New Microbial Composition Of Halitosis Patients' Tongue Biofilm. Microbiologyopen. 2020;9(2):E958.
[17] Ramya V, Hussain ST, Padmanabhan P. Personalised Periodontal Medicine-A [15]Paradigm Shift. Indian J Public Health Res Dev. 2019;10(11):3274-77.
[18] Malathi K, Sharmila K, Sable D, Ahamed S. Microbial Diagnosis In Periodontics: Merits And Demerits: A Review. J Dent Med Sci 2014; 13(2):104-107.
[19] Malathi K, Sharmila K, Sable D, Ahamed S. Microbial Diagnosis In Periodontics: Merits And Demerits: A Review. J Dent Med Sci 2014; 13(2):104-107.
[20] French CK, Savitt ED, Simon SL, Eklund SM, Chen MC, Klotz LC, Et Al. [59] DNA Probe Detection Of Periodontal Pathogens. Oral Microbiol Immunol. 1986;1(1):58-62.
[21] Zafiropoulos GG, Weiss O, Kasaj A, Willershausen B, Plancak D. Use Of DNA [60] Probes In The Diagnosis And Treatment Of Periodontitis-A Case Series. Coll Antropol. 2006;30(4):951-57.
[22] Silva NLC, Motta NAV, Soares MA, Araujo OMO, Espíndola LCP, Colombo APV, [61] Et Al. Periodontal Status, Vascular Reactivity, And Platelet Aggregation Changes In Rats Submitted To Hypercholesterolemic Diet And Periodontitis. J Periodontal Res. 2020;55(3):453-63.
[23] Chepuri T, Gooty JR, Durvasala S, Palaparthi R. Chair Side Diagnostic Test Kits In Periodontics. Indian J Dent Adv. 2015;7:41–45. [Google Scholar]
[24] Herr AE, Hatch AV, Giannobile WV, Throckmorton DJ, Tran HM, Brennan JS, [41] Et Al. Integrated Microfluidic Platform For Oral Diagnostics. Ann N Y Acad Sci. 2007;1098:362-74.
[25] Herr AE, Hatch AV, Throckmorton DJ, Tran HM, Brennan JS, Giannobile WV, Et [42] Al. Microfluidic Immunoassays As Rapid Saliva-Based Clinical Diagnostics. Proc Natl Acad Sci U S A. 2007;104(13):5268-73.
[26] Haffajee AD, Socransky SS. "Microbial Etiological Agents Of Destructive Periodontal Diseases." Periodontology 2000. 1994; 5(1): 78-111.
[27] American Academy Of Periodontology (AAP). "Comprehensive Periodontal Diagnosis And Risk Assessment." Journal Of Periodontology. 2006.
[28] Van Winkelhoff AJ, Et Al. "BANA Test: Detection Of BANA-Positive Bacteria And Its Relation To Periodontal Disease." Journal Of Clinical Periodontology. 1994; 21(8): 527-533.
[29] Goodson JM, Et Al. "Microbiological Diagnostics In Periodontics." Annals Of Periodontology. 1996; 1(1): 221-244
[30] Dr. Hemalatha DM, MDS, Dr. Anil Melath MDS, Dr. Subair K MDS, Afra P And Agalya B. An Overview On Periodontitis. Am J Biomed Sci & Res. 2024 24(4) AJBSR.MS.ID.003213, DOI: 10.34297/AJBSR.2024.24.003213