SALIVARY DIAGNOSTICS

Diagnosis, Management, and Maintenance of Periodontal Diseases

ITS DIAGNOSTIC VALUE FOR GENETICS AND CAUSATION AS VITAL ADJUNCTS TO CLINICAL SIGNS AND SYMPTOMS WITH CLINICAL PRESENTATION
Traditional diagnostic techniques for periodontal disease involve the identification of clinical signs and symptoms of disease.\cite{1,2} These usually include bleeding, pocket depth, redness, inflammation, and bone loss.\cite{1,2} While clinical signs can determine that an infection exists, they cannot determine the causative agents. Additionally, clinical signs are simply a measurement of the damage from a disease process that has already occurred. These signs do not tell us the types of bacteria present, knowledge of which is essential to determining the severity of the infection and/or the potential for disease progression after therapy. Moreover, clinical signs alone cannot determine if therapy has achieved the goal of elimination or suppression of the disease-causing agent(s).
SALIVARY DIAGNOSTICS

Although the most commonly used laboratory diagnostic procedures involve the analysis of the cellular and chemical constituents of blood, saliva is making strong inroads into the field of diagnostic medicine, as it has proven to be a useful medium from which to measure a wide range of hormones, pharmaceuticals, and antibodies.

Saliva has also proven to be a convenient source of human, bacterial, and viral DNA.

Thus, it can serve as an ideal source of diagnostic information, including genetic predisposition to periodontal disease, as well as a qualitative and quantitative analysis of the pathogenic bacteria that cause inflammation and infection. Two tests from OralDNA® Labs are available that assess both the bacterial and genetic aspects of periodontal disease: MyPerioPath® is a saliva-based DNA test that provides a rapid diagnosis of 11 species of oral pathogens considered to be causative agents of periodontal disease. MyPerioID® PST®, also a saliva-based DNA test, detects the presence or absence of two genetic polymorphisms of the IL-1 gene, a key regulator in the inflammatory process and a prime candidate for a genetic association with periodontal disease.3-6

Literature validates the value of salivary diagnostics as an accurate way to measure the biological phenotype. A comprehensive review of saliva as a diagnostic fluid was published in 1993, and other reviews of the diagnostic applications of saliva were published in 2002, 2007, and 2008.7-11 Saliva can be considered in two aspects: as gland-specific saliva, or as “whole” saliva. True to its name, gland-specific saliva is collected directly from individual salivary glands. The collection and evaluation of the secretions from individual salivary glands is primarily useful for the detection of gland-specific pathology, such as infection or obstruction. Whole saliva, on the other hand, is a mixture of oral fluids and includes secretions from both the major and minor salivary glands, in addition to constituents of non-salivary origin, such as gingival crevicular fluid (GCF), bronchial and nasal secretions, bacteria and bacterial byproducts, serum and blood derivatives, epithelial cells, viruses, and fungi. Whole saliva is most frequently used for diagnostic applications, since it is readily collected and contains serum (blood) constituents, which are necessary for DNA analysis.
IMPROVED RISK MANAGEMENT

Clinical laboratory medicine (e.g., laboratory testing) has become an essential component in medicine for a variety of reasons. The most compelling reason is that a physical examination looks only at the clinical signs and symptoms of disease and is not sufficient for a complete risk assessment.

Many biological factors that help to determine risk can be assessed by a wide range of laboratory tests using salivary fluid. Saliva provides a variety of potential analytes that, as adjuncts to clinical signs, provide the clinician with a more comprehensive risk assessment profile. In addition, early clinical signs that do not dissipate can be assessed from a molecular level to determine risk.

Specific bacteria, such as Porphyromonas gingivalis, Tannerella forsythia, Aggregatibacter (Actinobacillus) actinomycetemcomitans, Treponema denticola, Eubacterium nodatum, Fusobacterium nucleatum, Prevotella intermedia, Campylobacter rectus, Peptostreptococcus micros, and Eikenella corrodens are known to create immune responses in susceptible individuals that result in the clinical presentation of inflammation and eventual attachment loss. Thus, both Red and Orange Complex bacteria in sufficient concentration are considered to be etiological agents of different forms of periodontal infections. Plus, each biofilm infection is different based on the specific bacteria and present different risks for disease progression. Even early forms of infection can involve potentially very virulent pathogens that will not be detected by clinical signs alone. Thus, a diagnosis that is based on the actual causative agents in conjunction with clinical presentation provides a more definitive risk assessment.

THE CHAIRSIDE SAMPLE COLLECTION PROCESS

The primary components of a salivary DNA diagnostic test include a collection tube with a detachable funnel, a cap to seal the tube after sample collection, and a sterile saline solution. Collecting a sample of whole saliva takes about one minute, is easy and comfortable for the patient and clinician, and is entirely noninvasive. After labeling the sample collection tube, the patient swishes the saline solution around in the mouth for 30 seconds and then expectorates into the funnel/collection tube. The funnel is removed; the cap is secured to the top of the collection tube. This concludes the in-office part of the test. The sample is then placed in the provided specimen transport bag, sealed, and is now ready to be shipped to the laboratory. All of the laboratory DNA-PCR (polymerase chain reaction) procedures are performed by OralDNA® Labs, and a result report is sent to the clinician via a HIPAA-secure Internet portal within 4-5 business days.
DNA testing can provide a diagnosis based on the kinds (quality) of pathogenic bacteria as well as bacterial load (quantity/concentration). This information allows the ability to move from a differential diagnosis based on clinical signs to a working diagnosis based on the quantity and quality of disease-causing agents. A more complete working diagnosis allows the clinician to select the most appropriate antimicrobial strategy. The ability to differentiate between infections is helpful when the etiology is multi-bacterial. Additionally, the selection of therapies based on identification of specific bacteria and specific bacterial load provides a more specific and personalized approach to therapy. As of today, there is no single therapy that has been shown to be useful for all infections of these types.

Genetic testing complements bacterial testing by providing insight into the person’s inflammatory response to specific oral pathogenic bacteria, thus enabling a scientific basis for individualized re-care and therapy protocols for the patient. A genetic polymorphism in the individual’s interleukin-1 gene cluster—a significant inflammatory mediator—would suggest a more aggressive therapy protocol, such as more aggressive treatment that might include both non-surgery and surgery, appropriate medication utilization, and additional scheduling of maintenance appointments, than would otherwise be called for with a bacterial test result alone.

Furthermore, subsequent testing with MyPerioPath® based on bacterial risk, genetic risk, and additional modifying factors such as smoking, diabetes, severity of disease, family history, etc., as determined by the practitioner, can serve to confirm the efficacy of treatment. Depending on the severity of the periodontal disease, a patient can be re-tested as often as deemed necessary by the clinician. Test results can be compared and monitored over time, and treatment parameters can be maintained or adjusted as necessary before further attachment loss has occurred.

In addition to the laboratory results, the patient’s medical history also plays an important role in treatment planning. Patients with certain medical conditions, such as diabetes and cardiovascular disease, may present an increased risk for more serious periodontal infections, as well as increased risk for a less-desirable treatment outcome. This applies to people with certain lifestyle habits, too, such as smoking or chewing tobacco. Medical history information is especially important to correlate periodontal therapy with existing medications and medical risks. Also, patients with certain medical conditions may require consultation with their physician prior to initiation of antimicrobial therapy.
**THE CLINICAL LAB REPORT AS COMMUNICATION TOOL**

The test results are a valuable asset to share with the patient, as they demonstrate that these are objective results from a third party. The clinical laboratory report (test results) should be read, shown to, and discussed with the patient, since they serve to help define the diagnosis and make the condition “real” (i.e., “seeing is believing”). These dental clinical lab reports, as utilized in medicine, serve to help further define risk for disease and/or disease progression. They also help the patient make decisions based on biological information that confirms more specifically the disease itself and the risks associated with their specific infection. It thus serves as a persuasive means to instill the need for periodontal therapy and patient compliance in order to achieve the best possible treatment outcome.

The clinical lab report should also be considered as an informational tool to be shared, upon consent of the patient, with the patient’s primary care physician or any other medical professional that may be providing care to the patient on an ongoing basis, especially in situations where the patient’s periodontal status may have an impact on their systemic health.
Clinical laboratory reports have been used in medicine for decades for a variety of reasons; diagnosis, prognosis, monitoring of therapy, and treatment decision making, to name just a few. The data presented in the clinical lab reports for oral diseases such as periodontal disease and, eventually, other disease states, helps, first, to provide a more definitive diagnosis.

Clinical signs, while still important as a means of determining the damage that has been caused by an infection, do not indicate what the damaging or causative agents actually are. While inflammation is known to cause considerable damage, the initiation of the host response and the progression of this response are known to be caused by a variety of specific microorganisms.14,15 Plus, even early forms of infection can involve potentially very virulent pathogens that will not be detected by clinical signs alone. Thus, a diagnosis that is based on actual causative agents in conjunction with clinical presentation provides a more definitive diagnosis and risk assessment.

This modern movement toward a biological diagnosis that includes biological risk factors and medical history, along with clinical history, is becoming a major theme in periodontics. Since periodontal diseases are polymicrobial biofilm infections, it is important to know which specific bacteria or combinations of bacteria are responsible for the inflammatory response in each patient. These biofilm communities are not all the same and do not involve the same risk. Based on the actual species that are the causative agents for these inflammatory diseases, some are a high risk for attachment loss, some are considered to be associated with refractory and chronic infections, and some are more often implicated in systemic infections. This information is important to know at the earliest possible time in order to treat the actual causative agents of the disease.

SUMMARY

Clinical laboratory reports have been used in medicine for decades for a variety of reasons; diagnosis, prognosis, monitoring of therapy, and treatment decision making, to name just a few. The data presented in the clinical lab reports for oral diseases such as periodontal disease and, eventually, other disease states, helps, first, to provide a more definitive diagnosis.
REFERENCES