INTERNATIONAL SEVEN JOURNAL
OF HEALTH RESEARCH
ISSN: 2764-9415

The importance of interpreting complementary laboratory tests in routine dentistry: A brief review

A importância da interpretação de exames complementares laboratoriais na rotina odontológica: Uma breve revisão

DOI: 10.56238/isevjhv2n6-013
Receipt of originals: 01/12/2023
Publication acceptance: 12/21/2023

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ABSTRACT
In the context of the dental outpatient clinic, especially during surgical and invasive procedures involving the topical application of anesthesia, it is essential to carry out previous complementary and laboratory tests to assess the patient's general health status before the intervention. These tests play a crucial role in the early diagnosis of systemic diseases and in the follow-up of these conditions, aiming to control them to avoid interference with dental treatment. This study highlights the importance of several complementary exams in dental practice, offering clear and objective guidelines to the dentist on the interpretation of results, the appropriate request for exams, and the appropriate management of the patient.

Keywords: Laboratory tests and diagnoses, Hematological tests, Dentistry.

1 INTRODUCTION

Laboratory tests and clinical anamnesis are fundamental tools for the diagnosis and follow-up of pathologies (Leite *et al*., 2016). In the dental context, complementary laboratory tests play a crucial role in daily clinical practice, especially in the prior assessment of the global health status of patients undergoing interventions such as oral surgeries, dental implant placement, biopsies, and bone grafts, thus providing a safer surgical approach (Monteiro *et al*., 2022).

However, it is imperative that the Dental Surgeon be trained to indicate and interpret such exams in order to prevent postoperative complications, such as drug interactions, infections and inflammations (Netto *et al*., 2009). In this context, the present study aims to develop a guide for Dentists, aiming to assist them in requesting and interpreting the results of the exams, elucidating the relevance and meaning of the changes observed, in addition to addressing their implications in surgical and invasive dental procedures.

2 COMPLEMENTARY LABORATORY TESTS

2.1 HAEMATOLOGICAL EXAMINATIONS

2.1.1 Hemogram

The blood count is an analysis that comprises the differentiation between the white and red series, involving the white and red blood cell count, the measurement of hemoglobin, the determination of the globular value, the leukocyte count and the platelet count. In dentistry, its primary application occurs when clinical signs and symptoms suggest a possible dysfunction or alteration in the blood system, such as anemia, viral, bacterial and fungal infections, inflammation, changes in wound healing, variations in platelet count, presence of tumors and manifestations such as pallor, weakness, fatigue, drowsiness and tiredness (Tonani; Ferreira, 2001).

The blood count is categorized into red series, comprising erythrogram, hematometry, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, red blood cells, hemoglobin, hematocrit, erythrocyte sedimentation, and white series, which includes data on leukocytometry, neutrophils, basophils, eosinophils, monocytes, and lymphocytes, in addition to the platelet that categorizes the amount of platelets.

2.1.1.1 Red Series

2.1.1.1.1 Erythrogram

Evaluation of the cells responsible for transporting oxygen in the body (red blood cells, called erythrocytes or red blood cells). The hematological profile of these cells is determined by erythrocyte count, hemoglobin quantification, hematocrit measurement, and morphological analyses (Failace; Fernandes, 2015).

2.1.1.1.2 Hematometry

The measurement of red blood cells in relation to total blood volume is known as a red blood cell count. The reference value for this count is approximately 4,500,000/ml for women and 5,000,000/ml for men (Tonani; Ferreira, 2001).

2.1.1.1.3 Mean corpuscular volume (MCV)

The MCV represents an index that quantifies the size of red blood cells. Red blood cells with MCV less than 80 are classified as microcytic, while values greater than 95 indicate macrocytosis. Normocytic red blood cells have a MCV within the range considered normal.

Generally speaking, variations in the size of red blood cells are described as anisocytosis. When there is a decrease in MCV, it may be associated with anemia, either due to iron deficiency or genetic origin. On the other hand, elevated MCV is associated with certain types of anemia, alcoholism, or bone marrow changes (Naoum; Naoum, 2008; Tonani; Ferreira, 2001).

2.1.1.1.4 Mean corpuscular hemoglobin

It represents the actual proportion of hemoglobin in existence, with normal values ranging from 27 to 32. These values help in diagnosing the type of anemia, whether hyperchromic, normochromic, or hypochromic. Changes in hemoglobin levels may indicate conditions such as iron deficiency anemia, high alcohol consumption, thyroid dysfunction, vitamin B12 and folic acid deficiency (Tonani; Ferreira, 2001).

2.1.1.1.5 Mean corpuscular haemoglobin (MCHC) concentration

It is the determination of hemoglobin concentration by erythrocyte. High values are suggestive of alcoholism or pathologies associated with the thyroid gland. HCCM concentrations below 30% indicate hypochromia, characterized by lower red blood cell staining compared to the normal pattern, resulting from a subnormal hemoglobin concentration. This condition can be attributed to disorders such as anemia, heart failure, or hypothyroidism (Failace; Fernandes, 2015; Tonani; Ferreira, 2001).

2.1.1.1.6 Haemation

Red blood cells, also called red blood cells or erythrocytes, are the blood cells responsible for transporting oxygen in the body. Its reference values are between 4.2 and 5.9 million cells per microlitre (μL). A decrease in the concentration of these cells may indicate the presence of hemorrhage, anemia due to nutritional deficiency, or hemolysis. On the other hand, a concentration above the reference values suggests the possibility of polycythemia, respiratory failure, dehydration, or sepsis (Tonani; Ferreira, 2001).

2.1.1.1.7 Hemoglobina

The function of hemoglobin is to carry out the transport of oxygen. Its normal values are: between 11 to 17g/100ml. The evaluation of this substance is crucial in patients undergoing oral surgery, since anemic individuals face risks of complications during surgical procedures. The

reduction in hemoglobin levels may result in anoxia during anesthesia administration, hindering healing due to decreased oxygen circulation in the tissues (Tonani; Ferreira, 2001).

2.1.1.1.8 Hematocrit

It is the percentage of volume occupied by red blood cells or red blood cells in the total volume of blood. Average values range from 42 to 45ml/%. When hematocrit values are low, a decrease in the concentration of red blood cells in the blood is suggested, indicating possible clinical conditions such as anemia, excessive blood loss, kidney disease, iron deficiency, protein deficiency, or sepsis. On the other hand, an increase in hematocrit levels can be interpreted as a sign of dehydration, burns, or shock. Variations in hematocrit values may discourage the use of surgical procedures (Failace; Fernandes, 2015).

2.1.1.1.9 Erythrocyte sedimentation

It is the rate of sedimentation of erythrocytes used as a marker of inflammatory response. It has little clinical significance and the data generated are not specific (Tonani; Ferreira, 2001).

2.1.1.2 White Series

2.1.1.2.1 Leukocytometry

The white series refers to the total count and analysis of leukocytes, the defense cells present in 1 ml of blood, with a mean reference value between 4,000 and 10,000/mm³ (Malta *et al.*, 2019). These defense cells include neutrophils, eosinophils, basophils, rods, monocytes, and lymphocytes.

The evaluation of the white series is crucial to examine the responsiveness of the patient's body to viral, fungal and bacterial infections, as well as to inflammatory processes (Failace; Fernandes, 2015). The reduction in the count may indicate leukopenia, which is associated with medications such as immunosuppressants, post-irradiation chemotherapy, and chronic diseases. On the other hand, the elevation is called leukocytosis, and can be caused by leukemia and acute infections (Malta *et al*., 2019).

2.1.1.2.2 Neutrophils

Neutrophils constitute the first line of immune defense, accounting for approximately 55% to 70% of total leukocytes. Its primary function consists of phagocytosis of microorganisms, directing themselves to foci of infection (Tonani; Ferreira, 2001). Reference values range from 3%

to 5% (relative percentage) to 150 to 500/mm³ (absolute amount) for rod neutrophils, as well as from 55% to 65% (relative percentage) to 3,000 to 5,000/mm³ for segmented neutrophils. The reduction in the number of neutrophils is called neutropenia, and may indicate vitamin B12 deficiency, sickle cell anemia, mononucleosis, flu, among other conditions. On the other hand, elevation above normal (neutrophilia) suggests acute infections, postoperative infections, inflammation, among others. The importance of observing the left shift of neutrophils, associated with an unfavorable prognosis due to the presence of myelocytes and metamyelocytes in peripheral blood, is highlighted (Malta *et al*., 2019).

2.1.1.2.3 Basophils

Basophils have a low blood concentration and are associated with the synthesis of histamine. The reference interval for its presence in the blood is between 0% and 1% (Tonani; Ferreira, 2001). A reduced count may suggest immune deficiency, pregnancy, hyperthyroidism, or adverse drug reactions. On the other hand, an increase in concentration may be indicative of myeloid leukemia, allergies, chronic inflammation, chickenpox, Hodgkin's disease, among other conditions (Malta *et al*., 2019).

2.1.1.2.4 Eosinophils

Eosinophils are crucial defensive cells in the fight against parasitic infections. Its benchmarks fluctuate between 2% and 4%. The addition of these cells is called eosinophilia, while their reduction is called eosinopia. The increase in eosinophil levels may suggest the occurrence of allergic processes, worm infestations, pernicious anemia, among others (Tonani; Ferreira, 2001).

2.1.1.2.5 Monocytes

Monocytes play a crucial role in the elimination and control of infections, actively participating in the removal of necrotic tissues and in the defense against tumor cells and foreign agents. The increase in its amount is called monocytosis, and may be associated with conditions such as bacterial infections, monocytic leukemia, protozoal infections, among others. On the other hand, the reduction in the concentration of these cells is called monocytopenia, and is related to factors such as malnutrition, aplastic anemia, and Gaucher's disease (a disease characterized by lipid storage) (Malta *et al*., 2019; Tonani; Ferreira, 2001).

Monocytes, when located in tissues beyond the bloodstream, are activated and differentiated into macrophages, representing 3 to 10% of the total defense cells (Lorenzi, 2006).

2.1.1.2.6 Lymphocytes

Lymphocytes represent 25% to 30% of the total peripheral blood cells, constituting the second most prevalent type in the immune defense line. They play a crucial role in the immediate response against cancer cells and infections, especially those of a viral nature. Some subpopulations of lymphocytes are responsible for the production of antibodies and actively participate in immunological memory processes, conferring protection against recurrent infections by the same pathogen.

The increase in lymphocyte count, known as lymphocytosis, can be triggered by acute viral infections (such as the flu), chronic viral infections (such as syphilis), lymphosarcoma, among other causes. On the other hand, the reduction in the amount of lymphocytes, called lymphopenia, can be associated with conditions such as malnutrition, AIDS, advanced stage of Hodgkin's disease, among other etiologies (Malta et al., 2019; Lorenzi, 2006; Tonani; Ferreira, 2001). The reference values for lymphocytes are between 1,400 and 4,300 mm^3.

2.1.1.3 Platelet count

It is the study of platelet counts, and they are very important in the coagulation process and control of hemorrhages, an important factor of hemostasis (Tonani; Ferreira, 2001). In the occurrence of a vascular lesion, platelets migrate to the affected site. At the end of this complex process, a thrombus is formed, stopping the hemorrhage. Normal platelet levels range from 150,000 to 450,000 per microliter (µL) (Lorenzi, 2006). However, up to values close to 50,000, there are no difficulties in initiating coagulation.

In situations where the platelet count is below 10,000/µL, there is an imminent risk of death due to the possibility of spontaneous bleeding. This condition is called thrombocytopenia. On the other hand, when the values exceed the upper limit, it is characterized as thrombocytosis. Assessment of platelet count is crucial pre-surgically to determine the patient's risk of bleeding. In addition, it is essential in the investigation of patients with hemorrhagic conditions or frequent ecchymosis (purple spots on the skin) (Failace; Fernandes, 2015).

2.1.2 Coagulogram

The coagulogram is essential in the evaluation of the patient's coagulation factors, verifying their ability to achieve adequate hemostasis during surgical procedures. It is recommended that these tests be performed as part of the preoperative evaluation of the patient. Among the tests that make up the coagulogram are bleeding time, coagulation time, prothrombin time, activated partial thromboplastin time, thrombin time and the international normalised ratio (Franco, 2001; Tonani; Ferreira, 2001).

2.1.2.1 Bleeding time (ts)

It is the time it takes to stop bleeding no more than 4mm deep. The normal parameters of this indicator are between 2 to 8 minutes. An increase in TS may indicate thrombocytopenic purpura, especially in cases of infectious states. This parameter is associated with vascular problems and platelet count (Tonani; Ferreira, 2001).

2.1.2.2 Clotting Time (TC)

CT scans allow you to evaluate clotting factors, it is the time for blood to clot outside the blood vessels. Normal values can vary between 5 to 10 minutes. (Franco, 2001).

2.1.2.3 Tempo de protrombina (tp)

The PT represents the interval necessary for the formation of the fibrin clot, being activated by the extrinsic coagulation mechanism. Normal values are between 10 and 12 seconds (Tonani; Ferreira, 2001). PT is an assessment of coagulation factors II, V, VII, and X (Franco, 2001). Elevations in values may suggest fibrinogen and prothrombin deficiency, as well as deficiencies in extrinsic coagulation factors, liver deficiency, or lack of vitamin K. On the other hand, values below normal may indicate administration of multivitamins, use of oral contraceptives, and hormone replacement therapy (Franco, 2001).

2.1.2.4. Activated partial thromboplastin time (aPTT)

The ATTT analyzes the intrinsic and common pathway of the coagulation cascade, and they are more sensitive to coagulation factors VIII and IX.

2.1.2.5 Tempo de trombina (tt)

The test is done by analyzing the time of transformation of fibrinogen into fibrin. Its normal time is between 15-18 minutes (Tonani; Ferreira, 2001).

2.1.2.6 *International normalised ratio* (inr)

The INR (International Normalized Index) test is used to evaluate blood coagulation, and is intended for the detection of disorders in this process, for therapeutic follow-up with anticoagulants, such as warfarin, and for the analysis of hemorrhagic risk and liver function (Araújo; Domingues; Van Bellen, 2014). In healthy individuals, normal INR values are between 0.8 and 1.0. However, in patients treated with anticoagulants, there is a tendency towards higher values, usually oscillating between 2.0 and 3.0.

2.1.3 Hepatogram and Tests for Kidney Disease Detection

The hepatogram plays an indispensable role in the analysis of hepatic, renal and bile duct functions. It is an assessment of paramount importance for the dentist, particularly in the context of certain drug prescriptions that have the potential to affect the activities of these vital organs, and may exacerbate existing deficiencies. These tests are of great relevance in the preoperative evaluation of the patient, since liver deficiencies can influence coagulation factors, hindering homeostasis and tissue healing.

2.1.3.1 Oxaleacetic transaminase (TGO) or aspartate aminotransferase (AST) and pyruvic transaminase (TGP) or alanine aminotransferase (ALT)

The enzyme oxaloacetic transaminase (GOT), produced predominantly in the liver, is also found in other organs, such as the heart, kidneys, muscles, and brain. Pyruvic transaminase (TGP), in turn, is mostly synthesized in the liver, and abnormal values indicate, for the most part, liver disorders or deficiencies. Elevations of these enzymes may be suggestive of liver cell damage, infections, tumors, liver diseases, among other conditions (Leite *et al*., 2016). The reference values for GOT are between 5 and 40 U/L, while for GOT, they range from 7 to 56 U/L (*American Gastroenterological Association*, 2002).

2.1.3.2 GT range

The enzyme gamma glutamyl transferase, known as gamma GT, is synthesized predominantly in the liver and can also be detected in the pancreas and heart. The quantitative

evaluation of this enzyme provides the analysis of hepatic, bile duct and pancreatic activities (Leite *et al.*, 2016). High GT gamma values can suggest several conditions, such as excessive alcohol consumption, liver cirrhosis, liver dysfunction, and pancreatitis, among others. The reference ranges established are as follows: for females, 8 to 41 U/L, and for males, 12 to 73 U/L (*American Gastroenterological Association, 2002).*

2.1.3.3 Bilirrubina

Bilirubin, a product of blood filtering by the liver, is normally excreted in the feces and urine. Elevated bilirubin in the blood indicates abnormality. There are two forms: indirect bilirubin, associated with blood disorders such as pernicious anemia, hemolytic anemia and hemoglobinopathy, and direct bilirubin, whose increase is linked to factors such as excessive alcohol consumption, hepatitis, biliary obstruction, liver tumors, among others. Reference values are < 1.2 mg/dL (< 20 micromol/L) (*American Gastroenterological Association*, 2002).

2.1.3.4 Serum creatinine

Creatinine analysis is essential for the assessment of renal function. This test quantifies the blood glomerular filtration rate (GFR) and is used to assess renal function and determine the appropriate dosage of drugs excreted by the kidneys. The reference parameters are between 0.60 and 1.2 mg/dL for women, and 0.70 and 1.3 mg/dL for men (Inker; Schmid; Tighiouart, 2012).

2.1.3.5 Urea

Urea, which originates from the catabolism of proteins ingested by the patient as a food source, is synthesized by the liver and subsequently secreted into the bloodstream. The kidney, in turn, performs the filtration responsible for the excretion of urea in the urine. High concentrations of urea in plasma may signal liver and kidney dysfunction such as kidney failure and dehydration. Reference parameters for blood urea levels are in the range of 20 to 50 mg/dL (Small; Bawega; Burrows, 2021).

2.1.4 Tests for diabetes mellitus

Diabetes mellitus is characterized by dysfunction in insulin secretion and varying degrees of peripheral insulin resistance, resulting in hyperglycemia. There are two main types: type 1, marked by the absence of insulin production due to autoimmune destruction of beta cells in the pancreatic islets; and type 2, characterized by insulin resistance (*American Diabetes Association*,

2022). For diagnosis and monitoring, it is recommended to perform Fasting Glucose and Glycated Hemoglobin (HbA1C) tests (Holt; Devries; Hess-Fischl, 2021).

2.1.4.1 Fasting blood glucose

To perform this test, a fast of 8 to 12 hours is required. The range considered normal is 70 to 99 mg/dl. Values between 100 mg/dL and 125 mg/dL indicate altered fasting glucose or prediabetes, while equal to or greater than 126 mg/dL may suggest diabetes (*American Diabetes Association*, 2022).

2.1.4.2 Glycated hemoglobin (HBA1C)

Glycated hemoglobin, or HbA1c, is a blood test that evaluates the average blood glucose over the last 90 to 120 days. HbA1C is a form of hemoglobin that is chemically bound to a sugar, reflecting increased blood glucose. It is not necessary to be fasting for collection, and the reference values are: Normal = 4.5 to 5.6%, Prediabetes or risk of diabetes mellitus = 5.7 to 6.4%, Diabetes mellitus = ≥ 6.5% (*American Diabetes Association*, 2022).

2.2 SEROLOGICAL TESTS

2.2.1. HIV

When HIV infection is suspected, screening tests are performed that include HIV antibodies and antigens, such as p24 antigen. Positive results for the p24 antigen may emerge two weeks after the initial infection. In case of positivity, tests are performed to detect HIV-1 and HIV-2, as well as a test to quantify HIV RNA in the blood. HIV-1 is more pandemic, fast-moving, and infectious, while HIV-2 is endemic, slower, and less infectious (*The American Foundation for AIDS Research*, 2023). To monitor infection and perform safe dental procedures, CD4 count and viral load tests may be ordered. Low CD4 counts increase vulnerability to serious infections due to immunosuppression. With effective treatment, the viral load decreases, and the CD4 count recovers (Buttò *et al*., 2010).

2.2.2. Syphilis

Syphilis, a sexually transmitted infection caused by *Treponema pallidum*, can present oral lesions, requiring proper management by the dental surgeon for diagnosis. VDRL (*Venereal Disease Research Laboratory*) and FTA-ABS (Fluorescent Antitreponemal Antibody Absorption Test) are used for diagnosis (Rotta, 2005). VDRL, which is simpler and more common, can be

positive between 2 and 6 weeks after contamination, but carries a risk of false-positive results. The more specific treponemal tests have a shorter immunological window, and can be positive 7 to 10 days after the first lesions. FTA-ABS, once positive, remains positive even after the patient is cured. Currently, the VDRL is used for screening, and the FTA-ABS for confirmation after a positive result in the first test (Avelleira; Bottino, 2006).

2.2.3 Exame HBSAG

Hepatitis B virus (HBsAG) surface antigen testing diagnoses hepatitis B, a serious viral infection in the liver. The result is positive reactive and non-negative (Ferreira, 2000).

2.2.4 Testing for hepatitis c (anti-HCV)

The Anti-HCV test is performed to detect antibodies against the hepatitis C virus, a viral liver infection that can lead to serious complications. Reference values are either non-reactive (negative) or reactive (positive) (Strauss, 2001).

3 FINAL THOUGHTS

Complementary laboratory tests represent indispensable allies in the daily practice of dentistry, playing crucial roles in diagnostic processes, clinical interpretations and detailed patient evaluations. They are invaluable resources, playing a key role in treatment planning and postoperative management.

Acknowledging the magnitude of the contribution of these procedures is essential to understanding the true evolution of contemporary dental practice. By deepening our understanding of the intricate details provided by laboratory tests, we not only enrich our diagnostic process, but also pave the way for the implementation of more effective and, above all, personalized treatment strategies.

In an increasingly complex clinical landscape, the effective integration of laboratory data not only improves diagnostic accuracy, but also guides more informed therapeutic choices. This recognition of the interconnectedness between laboratory science and everyday clinical practice drives excellence in the dental approach, providing practitioners with the ability to translate advanced scientific knowledge into meaningful clinical interventions.

Therefore, we emphasize the continuous importance of investing in an in-depth understanding of complementary laboratory tests, as such knowledge not only strengthens the diagnostic basis, but also represents a differential in the offer of personalized and effective

treatments to our patients. This constant pursuit of excellence contributes not only to the individual advancement of professionals, but also to the collective progress of contemporary dentistry.

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