Investigations in Pediatric Dentistry

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ABSTRACT

Careful investigation of the blood is often the first step in the assessment of hematologic function and diagnosis of related diseases; many hematologic disorders are also identified by specific blood tests. Blood smears and hematologic parameters examination yields important diagnostic information about cellular morphology, quantification of the blood cellular components, and evaluation of the pathophysiology that allows the formation of broad differential diagnostic impressions, directing additional testing.

KEYWORDS: Complete Blood Count, Urine Investigation, Stool Investigations, Salivary Investigation

INTRODUCTION

Modern medical practice has become dominated by sophisticated and often expensive investigations. We forget that the judicious use of these tools, and the interpretation of the data that they provide, are crucially dependent on good medical skills. Indeed, a test should only be ordered if it is clear that the test result will influence the patient’s management and the perceived value of the resulting information exceeds the anticipated discomfort, risk and cost of the procedure. Before requesting any investigations clinicians should, therefore, analyze their patient’s condition carefully and draw up a provisional management plan.¹

VARIOUS INVESTIGATIONS

Complete Blood Count: A Complete Blood Count (CBC) is a blood panel requested by a doctor or other medical and dental professional that gives information about the patient’s blood cells, such as the number of cell for each cell type and the concentration of various protein minerals. Complete Blood Count includes Total leucocyte count (TLC), Differential leucocyte count (DLC), RBC count, hemoglobin, hematocrit, RBC indices, platelet count a peripheral smear examination.²

Hemoglobin: Hemoglobin (Hb) is the iron-containing coloring matter of red blood cell (RBC). It is a chromoprotein forming 95% of the dry weight of RBC and 30% to 34% of wet weight. The function of hemoglobin is to carry the respiratory gases, oxygen, and carbon dioxide, and it also acts as a buffer. The molecular weight of hemoglobin is 68,000.³

Blood Concentration Hemoglobin (CTHB G/DL) Normal Range:
• Adult -
  o Male: 13.5 - 17.5 g/dl
  o Female: 11.5 - 15.5 g/dl
• Newborn 15.0 - 21.0 g/dl
• Baby (3 month) 9.5 - 12.5 g/dl
• Child (1 year to puberty) 11.0 - 13.5 g/dl⁴

Direct cyanmethemoglobin method has been the gold standard for hemoglobin estimation and is cheap but time-consuming. A number of other methods are available such as hemoglobin color scale, Sahli technique, Lovibond-Drabkin technique, Tallqvist technique, copper-sulfate method, HemoCue, and automated hematology analyzers. Each method has a different working principle and its own advantages and disadvantages.⁵

Leukocyte Analysis: White blood cells (WBCs) or leukocytes are the colorless and nucleated formed elements of blood (leuko is derived from the Greek word leukos = white). Compared to RBCs, the WBCs are larger in size and lesser in number. Yet functionally, these cells are important like RBCs because of their role in the defense mechanism of the body and protect the body from invading organisms by acting like soldiers.⁶

Normal White Blood Cell Count:
• ADULT: 4,000 to 11,000/cu mm of blood.
• INFANT: 20,000/cu mm of blood
• CHILDREN: 10,000 to 15,000/ cu mm of blood⁶

Leukocyte Differentials: In differential leukocyte count, white blood cells are analyzed to find the relative percentage of each cell type. Uniform standards for performing manual differential leukocyte counts on blood smears have been proposed by the CLSI to ensure reproducibility of results between laboratories.⁶

Granulocytes
Neutrophils: The most common white blood cells in the blood of adults are neutrophils, they are 10–14 μm in diameter with a multilobular nucleus containing 2–5 segments and granules in their cytoplasm.¹
Eosinophils: In circulating white blood cells, eosinophils represent 1–6% of the total amount. They are a similar size to neutrophils but have a bilobed nucleus and prominent orange granules on Romanowsky staining.7
Basophils: Basophils representing less than 1% of the circulating white blood cells.7 These cells are less common than eosinophils.

Agranulocytes
Monocytes: Among the white cells, monocytes are the largest cells, with a diameter of 12–20μm and an irregular nucleus in abundant pale blue cytoplasm containing occasional cytoplasmic vacuoles.
Lymphocytes: Lymphocytes are derived from pluripotent hematopoietic stem cells in the bone marrow. There are two main types: T cells (which mediate cellular immunity) and B cells (which mediate humoral immunity).7

Leukocytes may be enumerated by either manual methods or automated hematology analyzers. Leukocytes are counted after dilution of blood in a diluent that lyses the RBCs (usually acid or detergent). In comparison to red blood cell count the much lower numbers of leukocytes present require less dilution of the blood (usually a 1:20 dilution, although it may be less in cases of Leukocytopenia or more with leukocytosis). Manual counts are done using a Hemocytometer or counting chamber.1

Clinical considerations:
• When a patient is being treated with a medication that suppresses WBC production (such as antineoplastic agents,) the patient is at greater risk for postoperative infection and dental treatment should be deferred until the WBC result is back to normal.
• For invasive dental treatment, perioperative antibiotics are indicated in patients with ANC (absolute neutrophil count) less than 1000 cells/mm3 in order to minimize the risk of infection. When the ANC falls below 500 cells/mm3 intravenous antimicrobial therapy may be necessary to prevent sepsis resulting from invasive dental treatment.

Red Cell Count (Erythrocytes): Erythrocytes were first described in the 17th century. The Dutch microscopist, Leeuwenhoek, took note of them, as did Malpighi, who mistook them for fat globules “looking like a rosary of red coral.”7 Red cell formed in the bone marrow, derived from a primitive precursor, or erythroblast.7

Normal Range of RBC7
• Newborns -4.8 –7.2 million/ cubic mm
• Children-3.8–5.5 million/ cubic mm
• Adults
  o Male:5 million/cubic mm
  o Female: 4.5 million/cubic mm

Clinical consideration: Patient with polycythemia may experience orthopnea in the dental chair, dizziness, headache, red facial coloring, and dyspnea.

It is a necessary part of the assessment in patients with burning mouth disorders and aphthous stomatitis.

Volume of Packed Red Cells (Hematocrit): Packed cell volume (PCV) is the proportion of blood which is occupied by RBCs, expressed in percentage. When the blood is centrifuged, the volume of RBCs which is packed at the bottom of a hematocrit tube is known as Packed cell volume. It is also called hematocrit value or erythrocyte volume fraction (EVF).9

Normal Values of PCV
Normal PCV:
• Newborns =55% to 68%
• One month of age=37% to 49%
• Three months of age=30% to 36%
• One year of age=29% to 41%
• Ten years of age=36% to 40%
• Adult
  o Males = 42% to 54%
  o Females = 38% to 46%.10

It may be determined manually by centrifugation of blood at a given speed and time in a standardized glass tube with a uniform bore, as was originally described by Wintrobe. The height of the column of red cells after centrifugation compared with total blood sample volume yields the Hct. There are two methods, in macro methods using 3-mm test tubes with low-speed centrifugation and in micro methods using capillary tubes and high-speed centrifugation.1

Mean Corpuscular Volume: The average volume of the red blood cell is a useful parameter that is used in the classification of anemia and may provide insights into the pathophysiology of red cell disorders.7 MCV is the average volume of a single RBC, and it is expressed in cubic microns (cu μ).

Normal Value: Normal MCV is 90 cu μ (78 to 90 cu μ).8

Mean Corpuscular Hemoglobin: MCH is a measure of the average hemoglobin content per red cell. It may be calculated manually or by automated methods using the following formula:
• MCH = hemoglobin (g/L)/red cell count (10-12/L)
• The normal value of MCH is 30 pg (27-32 pg)8
• MCH is expressed in picograms.1

Mean Corpuscular Hemoglobin Concentration: It is the average concentration of hemoglobin in a given red cell volume. MCHC may be calculated by the following formula:
• MCHC = hemoglobin (g/dL)/Hct (L/L)1
• Normal value of MCHC is 30% (30-38%).9

Clinical consideration: MCV, MCH, and MCHC reflect average values and may not adequately reflect RBC changes when mixed RBC populations are present such as dimorphic RBC Population in Sideroblastic anemia or combined iron deficiency anemia (decreased MCV and MCH) and Megablastic anemia (increased MCV AND MCH)11
Platelet: Platelets or thrombocytes are the formed elements of blood. Platelets are small colorless, non-nucleated, and moderately refractive bodies. These formed elements of blood are considered to be the fragments of cytoplasm.12

Normal Count:
- Normal platelet count is 2,50,000/cu mm of blood. The range is in between 2,00,000 and 4,00,000/cu mm of blood.
- Platelets are less in infants (150,000 to 2,00,000/cu mm) and reach the normal level at 3rd month after birth.
- There is no difference in the platelet count between males and females.12

Clinical consideration:
- Platelet count for Minor surgery in dentistry should be greater than 50000/cu mm
- Bleeding disorder or bone marrow disease such as Leukemia, require the platelet count prior to invasive surgery.19

Blood Coagulation Investigations: Blood samples obtained by traumatic venipunctures or from indwelling catheters often are inadequate for coagulation studies. A poorly collected blood sample is a far more common cause of inaccurate results than is technical error (Table 1).18

Clinical consideration: Determination of ESR is especially helpful in assessing the progress of patients treated for certain chronic inflammatory disorders such as:
1. Pulmonary tuberculosis
2. Rheumatoid arthritis
3. Polymyalgia rheumatic (an inflammatory disease characterized by pain in shoulder and hip)
4. Temporal arteritis (inflammation of arteries of head).
5. Indication of infection if ESR value is increased.

Investigations For Screening of Diabetes Mellitus: As per the WHO, Diabetes Mellitus is a heterogeneous metabolic disorder characterized by the common feature of chronic hyperglycemia with disturbance of carbohydrate, fat, and protein metabolism.13

Interpretation (Venous Plasma Glucose)15 Table 2:

<table>
<thead>
<tr>
<th>Laboratory test</th>
<th>Normal range</th>
<th>Increase range</th>
<th>Decrease range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeding time</td>
<td>3.6 Min.</td>
<td>Purpura 12</td>
<td></td>
</tr>
<tr>
<td>Clotting time</td>
<td>3.5 Min.</td>
<td>Hemophilia</td>
<td></td>
</tr>
<tr>
<td>Prothrombin time</td>
<td>10-14 Sec.</td>
<td>Deficiency in prothrombin, factors like 1,5,7,10</td>
<td>Extensive cancer, except when liver is involved. Immediately after acute hemorrhage. Very early stage of DIC</td>
</tr>
<tr>
<td>Activated partial thromboplastin</td>
<td>30-40 Sec.</td>
<td>Von Willebrand’s disease, Hemophilia, Vitamin K deficiency, Liver disease, Presence of circulating anticoagulants, DIC disease</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Table Summarizing Physiological values of Various coagulation test and Pathological conditions showing increase or decrease counts12

Erythrocyte Sedimentation Rate: The erythrocyte sedimentation rate (ESR) is a common but nonspecific test that is often used as an indicator of active disease. It reflects the tendency of RBCs to settle more rapidly in the face of some disease states, usually because of increases in plasma fibrinogen, immunoglobulins, and other acute-phase-reaction proteins.12

Normal Values of ESR:
By Westergren Method
- Infants : 0 to 2 mm in 1 hour
- In males : 3 to 7 mm in 1 hour
- In females : 5 to 9 mm in 1 hour

By Wintrobe Method:
- Infants : 0 to 5 mm in 1 hour
- In males : 0 to 9 mm in 1 hour
- In females : 0 to 15 mm in 1 hour12

Clinical considerations:
- Oral manifestations of uncontrolled diabetes can include xerostomia, burning sensation in the mouth.
- Impaired / delay wound healing, Increase incidence and severity of infections, secondary infection with candidiasis, parotid salivary gland enlargement, gingivitis, and/ or periodontitis.

Test For Disturbances In Bone Calcification Calcium:
Calcium is the most abundant among the minerals in the body. The total content of calcium in an adult man is about 1 to 1.5 kg. As much as 99% of it is present in the bones and teeth. A small fraction 1% of the calcium, found outside the skeletal tissues, performs a variety of function.15

Normal Value:
Adults
- 18–60 years - 8.6–10.5 mg/dL
- 60–90 years - 8.8–10.7 mg/dL

Children
- Cord blood - 8.2–11.2 mg/dL
- Premature infant- 6.2–11.0 mg/dL
- < 10 days- 7.6–10.4 mg/dL
- 10 days–2 years -9.0–11.0 mg/dL
- 2–12 years- 8.8–10.8 mg/dL
- 12–18 years- 8.4–10.5 mg/dL

Panic levels
- Tetany- < 7 mg/dL
- Coma> 12 mg/dL
- Possible death- < 6 mg/dL16

Phosphorus: Phosphorus is a mineral that combines with other substances to form organic and inorganic phosphate compounds. The terms phosphorus and phosphate are
often used interchangeably when talking about testing. In serum phosphorus/phosphate test, the amount of inorganic phosphate in the blood is measured.\(^1\)

**Normal Value:**
- Adults < age 60 2.7–4.5 mg/dL
- Females > age 60 2.8–4.1 mg/dL
- Males > age 60 2.3–3.7 mg/dL
- Cord blood 3.7–8.1 mg/dL
- Premature infant 5.4–10.9 mg/dL
- Infant (10 days–24 months) 4.5–6.7 mg/dL
- Newborn 4.5–9 mg/dL
- Child (24 months–12 years) 4.5–5.5 mg/dL\(^4\)

**Investigations For Syphilis Screening:** Syphilis is caused by infection with the spirochaete *Treponema pallidum*, through abrasions in the skin or mucous membranes. In adults, the infection is usually sexually acquired; however, transmission by kissing, blood transfusion and percutaneous injury have been reported. Transplacental infection of the fetus can also occur. Infection may remain latent throughout, or clinical features may develop at any time.\(^5\)

**Investigations of Syphilis:** A dark-field microscope, a direct fluorescent antibody test or PCR (polymerase chain reaction) are used for identification of *T. pallidum*, which is present in serum collected from chancrees, or from moist or eroded lesions in secondary syphilis.\(^7\)

**Investigations for HIV Screening:** HIV (human immunodeficiency virus) is the virus that causes AIDS (acquired immunodeficiency syndrome). HIV progressively destroys the body’s ability to fight against infections and certain cancers. It weakens the immune system by infecting lymphocytes, which is a type of white blood cell, that normally helps the body to fight against infections. Specific lymphocytes known as T-helper cells or CD4 cells are major targets for HIV. The virus binds to CD4 cells, enters them, replicates inside them, and eventually kills them.\(^8\)

**Screening Test**
- ELISA
- HIV Confirmatory Tests
  - Immunoblot
  - Western blot
  - Indirect immunofluorescent antibody assay (IFA)
  - Radio immuno-precipitation assay (RIPA)
  - Line immuno-assays
  - PCR\(^9\)

**Investigations For Typhoid:** Typhoid fever is an acute febrile systemic infection caused by *Salmonella typhi* with an initial lesion in the bowel, bacteremia, and subsequent affection of many tissues.

**Laboratory Diagnosis:**
- WIDAL Test: This identifies the agglutinating antibodies against the O and H antigens for *S. typhi* and *S. paratyphi* A and B.
- ELISA: A new technique of rapid screening for *Salmonella* by dipstick enzyme-linked immunosorbent assay (ELISA) has been shown to be sensitive, specific, rapid and reproducible for detection of *Salmonella* directly from stool.\(^10\)

**Investigations To Determine Liver Function:** The Liver performs several diversified functions. It is the central organ of the body’s metabolism. Liver function tests are most often employed to determine: (i) the presence of liver disease, (ii) the type of liver disease, and (iii) the extent and evaluation of the liver disease.\(^11\)

**Marker of Liver Function**
- **Aspartate aminotransferase (AST):** A very high level of ALT is frequently seen with acute hepatitis. Moderate increases in ALT may be seen with chronic hepatitis. People with blocked bile ducts, cirrhosis, and liver cancer may have ALT concentrations that are slightly elevated or close to normal.\(^12\)

- **Albumin:** In any disease causing hepatocellular damage, the concentration of serum albumin decreases. In many liver disorders, serum globulins may rise to such a level so as to maintain normal or increased total protein concentration even when there is severe albumin depletion.\(^13\)

**Normal values are dependent upon methods/ kits/ manufacturers**

**Alanine Aminotransferase (ALT or SGPT):**
- Adult female 4–35 U/L
- Adult male 7–46 U/L
- Children
  - < 12 months ≤ 54 U/L
  - Age 1–2 years 3–37 U/L
  - Age 2–8 years 3–30 U/L
  - Age 8–16 years 3–38 U/L

**Alkaline Phosphatase (ALP):**
- Adults
  - Age 20–60 years
    - Bodansky 2–4 U/dL 10.7–21.5 IU/L
    - King-Armstrong 4–13 U/dL 25.0–92.3 IU/L
    - Bessey-Lowery-Brock 0.8–2.3 U/dL 13.3–38–3 IU/L
    - Elderly Slightly Higher

**Normal Value:**
- Liver Function
  - Alkaline Phosphatase (ALP)\(^14\)
    - Children
      - < 12 months 21.5 IU/L
      - Age 1–2 years 32.7 IU/L
      - Age 2–8 years 56.2 IU/L
      - Age 8–16 years 79.2 IU/L

**Bilirubin:** Bilirubin is increased in the blood when too much is being produced; less is being removed, which may be due to bile duct obstructions, or to problems with bilirubin processing. It is common to see high bilirubin levels in newborns, typically 1 to 3 days old.
- Newborn: 1–4 times adult values
- Children: Values remain high until epiphyses close
- Female: Age 2–10 years: 100–350 U/L, Age 10–13 years: 110–400 U/L
- Male: Age 2–13 years: 100–350 U/L, Age 13–15 years: 125–500 U/L

**Investigations For Detection Of Jaundice:** Jaundice or icterus is the condition which is characterized by the yellow coloration of the skin, mucus membrane, and deeper tissues due to increased bilirubin level in blood. The word jaundice is derived from the French word ‘jaune’ meaning yellow.

Normal Count: The normal serum bilirubin level is 0.5 to 1.5 mg/dL. Jaundice occurs when bilirubin level exceeds 2 mg/dL.

**Diagnosis:** Majority of cases can be diagnosed by the history, physical examination, and simple biochemical tests. Preliminary tests include an examination of urine, history, physical examination, and simple biochemical and immunological tests of the serum.  

**Vitamin Deficiency Test:** The need for tests which are capable of detecting and diagnosing vitamin deficiencies arises from a variety of disparate activities and needs. National surveys of the kind performed recently in the UK and the US, seek to define ‘hot-spots’ of increased risk, for particular nutrients and for particular population groups.

**Practical Details Of The Principal Biochemical Status Assays**

<table>
<thead>
<tr>
<th>Vitamin(s)</th>
<th>Sample</th>
<th>Preferred Type Of Assay (Reference)</th>
<th>Special Precautions Or Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, E, carotenoids</td>
<td>Serum or plasma</td>
<td>High pressure liquid chromatography (HPLQ)</td>
<td>Avoid haemolysis and light exposure</td>
</tr>
<tr>
<td>25(OH)D and 1,25(OH)D</td>
<td>Serum or plasma</td>
<td>Kit radiointunammyassay (RIA) or HPLC</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>Serum or plasma</td>
<td>HPLC with fluorescence Detection</td>
<td>(Few labs currently have this capability)</td>
</tr>
<tr>
<td>C</td>
<td>Serum or plasma</td>
<td>HPLC (electrochemical detection) etc.</td>
<td>Stabilise, preferably with metaphosphoric acid, store at very low temperature*</td>
</tr>
<tr>
<td>Thiamin</td>
<td>Washed red cells</td>
<td>Transketolase activation Coefficient</td>
<td>Store at very low temperature; avoid freeze-thaw cycles</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>Washed red cells</td>
<td>Glutathione reductase Activation coefficient</td>
<td>Store at very low temperature; avoid freeze-thaw cycles</td>
</tr>
<tr>
<td>Vitamin B6</td>
<td>Washed red cells Serum/ plasma</td>
<td>Aspartate transaminase Activation coefficient</td>
<td>Store at very low temperature; avoid freeze-thaw cycles</td>
</tr>
<tr>
<td>Folate</td>
<td>Serum plasma or stabilised whole blood</td>
<td>Competitive binding or in-house microbiological assays</td>
<td>Whole blood needs ascorbate stabiliser, and haematocrit Assay</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>Serum/ plasma</td>
<td>Kit (competitive binding) or in-house microbiological assays</td>
<td>Avoid contamination</td>
</tr>
</tbody>
</table>

**Investigations For Detection Of Thyroid And Parathyroid Gland Dysfunction:** At present, thyroid disease from the second most common endocrine disorder in India next only to diabetes mellitus. If the asymptomatic endemic goiter is also included, thyroid disease may even rank as the most common endocrine disease.

**Various Test For Detection Of Thyroid And Parathyroid Gland Disfunction**

**Thyroid Stimulating Hormone Test (TSH Test):** For evaluating thyroid function and/or symptoms of a thyroid disorder, including hyperthyroidism or hypothyroidism; thyroid-stimulating hormone (TSH) test is the test of choice.

**T3 Test:** Total triiodothyronine (Total $T_3$) is rarely measured, having been largely superseded by free T3 tests. Total T3 is generally elevated in hyperthyroidism and decreased in hypothyroidism.

**T4 Test:** Total thyroxine is rarely measured, having been largely superseded by free thyroxine tests. Total thyroxine (Total $T_4$) is generally elevated in hyperthyroidism and decreased in hypothyroidism. It is usually slightly elevated in pregnancy secondary to increased levels of thyroid-binding globulin (TBG).

**Drug Allergy Tests:** Drug allergy is an unpredictable immunologically mediated response to a pharmaceutical and/or formulation (excipient) agent in a sensitized person with heterogeneous mechanisms and clinical presentations. It can occur at doses significantly below the therapeutic range. Drug allergy should be differentiated from drug idiosyncrasy which is an abnormal and unexpected drug effect that is unrelated to its intended pharmacologic action, reproducible on administration and is usually related to underlying abnormalities of metabolism, excretion or bioavailability.

**Test For Drug Allergy**

**Mantoux test:** The Mantoux test or Mendel-Mantoux test (also known as the Mantoux screening test, tuberculin sensitivity test, or Purified protein derivative (PPD) test for purified protein derivative) is a screening test for tuberculosis (TB) and for tuberculosis diagnosis. It is one of the major tuberculin skin tests used around the world, largely replacing multiple-puncture tests such as the tine test.

**Tuberculin test:** Tuberculin, also known as purified protein derivative, is a combination of proteins that are used in the diagnosis of tuberculosis. This use is referred to as the tuberculin skin test and is recommended only for those at high risk. An injection is done into the skin. After 48 to 72 hours if there is more than a five to ten-millimeter area of swelling the test is considered positive.

**Urine Investigation:** Examination of urine is an indispensable part of the evaluation of patients with
impaired kidney function, particularly proteinuria, hematuria, urinary tract infection, nephrolithiasis, and other renal or nonrenal diseases. The relatively simple chemical test performed in the routine urinalysis rapidly provides important information about primary kidney disorder and systemic diseases.27

**Kidney Function Test**

**Serum creatinine:** Creatinine is filtered through the glomerulus. Under ordinary circumstances, the clearance of endogenous creatinine approximates the glomerular filtration rate.

**Normal Range:**
- Males 110–150 Ml/Min
- Females 105–132 mL/min

**Causes for Reduced Creatinine Clearance**
- Acute: Shock, hypovolemia, nephrotoxic chemicals, acute glomerulonephritis, malignant hypertension, eclampsia.
- Chronic: Glomerulonephritis, pyelonephritis, hypertensive nephrosclerosis, polycystic kidneys.28

**Stool Analysis:** Average healthy adults defecate from three times a day to three times a week. The common pattern is once a day. The stool tends to be soft and bulky on a diet high in vegetables and small and dry on a diet high in meat. Two-thirds of the stool weight are attributable to its water content. The normal brown color is of still undetermined origin. The odor results from indole and skatole, produced by bacteria from tryptophan.29

**Salivary Investigations:** Saliva in humans is a mouth fluid possessing several functions involved in oral health and homeostasis, also play an active protective role in maintaining oral healthiness. Saliva helps in bolus formation by moistening food, protects the oral mucosa against mechanical damage, and plays a role in the preliminary digestion of food through the presence of α-amylase and other enzymes. It also facilitates taste perception, allowing soluble food-derived molecules to reach the gustative papillae and buffer the acid components of food with the bicarbonates (originating from salivary gland carbonic anhydrase). Saliva also has a role in maintaining teeth enamel mineralization: several proteins like Catherine, proline-rich proteins – (PRPs) and mucins allow Ca++ supersaturation in saliva to be maintained.30

**Saliva As A Diagnostic Tool:** Oral fluid sampling is safe, easy, and has low-cost storage for the operator and the patient. These characteristics make it possible to monitor several biomarkers in infants, children, elderly and non-collaborative subjects and in conditions where blood and urine sampling is not available.30

**Caries Activity Analysis:** Caries activity tests are based on the concept of a specific odontopathic infection, the common causative organism being *Streptococci mutans*. Their predominance is attributed to its acidogenic and aciduric nature over the other non-acid tolerant organisms.

**Definitions:** Caries activity is defined as “The occurrence and rate at which teeth are destroyed by the acid produced by plaque bacteria.”31

**Caries activity analysis is classified in to:**
A. Tests which measure caries activity:
   - Lactobacillus colony count test
   - Streptococcus mutans level in saliva
   - S. Mutans screening tests
     - Plaque-tooth pick method
     - Saliva/tongue blade method
     - S. Mutans adherence method
     - S. Mutans dip-slide method
     - S.mutans replicate technique
   - Alban test
   - Dewar test
   - Swab test
   - Salivary buffer capacity test

B. Tests which measure caries susceptibility:
   - Snyder’s colorimetric test
   - Enamel solubility test
   - Dewar test
   - Fosdick calcium dissolution test
   - Salivary reductase test

**CONCLUSION**

Clinical laboratory investigations nowadays are being utilized as future predictors. On getting warning signals, one can take necessary corrective measures (lifestyle and/or dietary) and can prevent diseases from striking or at least deferring or postponing their arrival.

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