



دانشگاه علوم پزشکی و خدمات بهداشتی درمانی کرمانشاه
دانشکده دندانپزشکی

شناسه: ۱۸۲۹۵۶

وبینار علمی تجویز و تفسیر آزمایشات خون در اقدامات دندانپزشکی



دکتر آرش دهقان

متخصص آسیب شناسی تشریحی و بالینی
دانشیار دانشگاه علوم پزشکی همدان
تفسیر اجزاء آزمایش کامل خون



دکتر عرفانه امینی

متخصص آسیب شناسی دهان، فک و صورت
استادیار دانشگاه علوم پزشکی کرمانشاه



اندیکاسیون های تجویز آزمایش خون در دندانپزشکی
مقادیر قابل قبول اندکس های خونی به تفکیک اقدامات دندانپزشکی
معرفی مختصر چند کیس با اختلال سیستمیک



**“BEFORE ORDERING A TEST, DECIDE WHAT YOU WILL DO IF IT IS EITHER
POSITIVE OR NEGATIVE.
IF BOTH ANSWERS ARE THE SAME, THEN DON’T DO THE TEST.”**

Laboratory medicine is the division of medical science dealing with the qualitative and quantitative assessment or analysis of blood (formed elements and fluid components) and other cells and body fluids.

Clinical chemistry, microbiology, hematology, immunology, molecular diagnostics, cytology, toxicology, therapeutic drug monitoring, genetics, and histology are various components of laboratory medicine.

- ☐ The interpretation of test results depends on what is already known about the patient.
- ☐ No test is perfect. Clinicians should be familiar with their diagnostic performance and never believe that a test “forces” them to pursue a specific management strategy.
- ☐ Tests should be ordered if they may provide additional information beyond that already available.
- ☐ Tests should be ordered if there is a reasonable chance that the data will influence patient care.
- ☐ Two tests that provide similar information should not be used.
- ☐ In choosing between two tests that provide similar data, use the one that has lower cost and/or causes less discomfort and inconvenience to the patient.
- ☐ Clinicians should seek all the information provided by the test, not just an abnormal or normal result.
- ☐ The cost-effectiveness of strategies using noninvasive tests should be considered in a manner similar to that of therapeutic strategies.⁹

There are several physical signs or clues that indicate a patient who reports having received no medical care might not truly be healthy, but rather simply not accessing medical care:

- age over 40 years;
- obese or cachectic body habitus;
- low energy level;
- abnormal skin coloration;
- poor oral hygiene;
- tobacco smoking.

The ability to perform common daily tasks can be expressed in metabolic equivalents of tasks (METs), which quantify the body's use of oxygen.

Thus, the patient's ability to meet MET levels as determined for specific activities reflects general physical status.

A MET is a unit of oxygen consumption; 1 MET equals 3.5 mL of oxygen per kg of body weight per minute at rest.

It has been shown that the risk for occurrence of a serious perioperative cardiovascular event (e.g., MI, heart failure) is increased in patients who are unable to meet a 4-MET demand during normal daily activity.

2 Daily activities requiring 4 METs include level walking at 4 miles/hour or climbing a flight of stairs.

Thus, a patient who reports an inability to walk up a flight of stairs without shortness of breath, fatigue, or chest pain may be at increased risk for medical complications during dental treatment, especially when such limitation is combined with other risk factors and the patient is under stress.

Four key risks of dental care

- Impaired hemostasis
- Susceptibility to infections
- Drug actions/interactions
- Patient's ability to tolerate dental care

Impaired Hemostasis

The four phases of hemostasis

- Vascular
- Platelet
- Coagulation
- Metabolic/fibrinolytic



Figure 1.7 Petechiae and mucosal pallor due to aplastic anemia.



Figure 1.9 Purpura of arm skin due to alcoholic cirrhosis.



Figure 1.14 Spider angioma of skin due to severe liver disease.



Figure 1.13 Jaundice of sclera of eye due to severe liver cirrhosis.



Figure 1.12 Hemosiderin-stained calculus on teeth from chronic oral bleeding due to severe hemophilia A.



Figure 1.10 Hematoma of finger due to severe hemophilia A.



Figure 1.11 Spontaneous gingival bleeding due to severe thrombocytopenia.



Figure 1.8 Petechiae and ecchymoses of tongue and lip due to severe thrombocytopenia.

Thrombocytopenia

- . CBC →→→ platelet count $<150 \times 10^9$

Thrombocitopathy

- . platelet function tests →→→ PFA-100

hereditary coagulation disorders

- . Partial thromboplastin time (PTT) →→→ Intrinsic pathway (VIII, IX, XI, and XII)
- . prothrombin time/international normalized ratio (INR) →→→ extrinsic and final common pathways (VII, II (prothrombin), V, X, and fibrinogen)

drug induced

- . prothrombin time/international normalized ratio (INR) →→→ Warfarin
- . Partial thromboplastin time (PTT) →→→ Heparin
- . Ivy test
- . CT

vitamin deficiency

- . vitamin K

liver cirrhosis

- . liver function tests (Alanine transaminase (ALT), Aspartate transaminase (AST), Alkaline phosphatase (ALP), Albumin and total protein, Bilirubin)

leukemia

- . CBC, bone marrow aspiration and biopsy, cytogenetic studies ...

aplastic anemia

- . CBC, bone marrow aspiration and biopsy, cytogenetic studies ...

In general, the platelet count should be above 50,000 and INR below 2.0–3.0 for surgical procedures, depending on the extent of surgery

nonsurgical dental procedures may be safely performed in the higher INR ranges (below 3.5) and lower platelet counts.

Safety of Outpatient Dental Procedures for Patients on Coumadin®

Dental Procedure	Suboptimal INR Range		Normal Target INR Range			Out of Range
	<1.5	1.5 to <2.0	2.0 to <2.5	2.5 to 3.0	>3.0 to 3.5	>3.5
				<i>Mechanical Prosthetic Heart Valves</i>		
			<i>Atrial Fibrillation; Venous Thrombosis; Pulmonary or Systemic Embolism; Acute MI</i>			
Examination, radiographs, impressions, orthodontics						
Simple restorative dentistry, supragingival prophylaxis						
Complex restorative dentistry, scaling & root planing, endodontics					Probably safe	
Simple extraction, curettage, gingivoplasty, biopsy				Local measures§	Local measures§	
Multiple extractions, single bony impaction extraction			Local measures§	Local measures§	Local measures§	
Gingivectomy, minor periodontal flap surgery, apicoectomy, single implant placement	Probably safe	Probably safe	Probably safe			
Full mouth or full arch extractions	Probably safe	Local measures§				
Extensive flap surgery, extraction of multiple bony impactions, multiple implant placement	Probably safe					

INR= International Normalized Ratio; MI= Myocardial Infarction. Green indicates that it is safe to proceed in a routine manner (local factors such as periodontitis/gingival inflammation can increase severity of bleeding; the clinician should consider all factors when making a risk assessment). Yellow, use caution, but in many instances the procedure can be safely performed with judicious use of local measures. Red, procedures not advised at current INR level; refer to physician for Coumadin® adjustment.

§ Increased need for use of local measures such as sutures, oxidized cellulose, microfibrillar collagen hemostat, topical thrombin and/or epsilon aminocaproic acid or tranexamic acid. (Herman WW, Konzelman Jr JL, Sutley SH. Current perspectives on dental patients receiving coumarin anticoagulant therapy. JADA 1997;128(3):327-35. Copyright © 1997 American Dental Association. All rights reserved. Adapted 2011 with permission of the American Dental Association.)

Table 8.5 Normal CBC and Differential WBC Count^a and Disease-Related Changes^{24,25}

Blood Cell Type	Normal Reference Range		May Be Increased In	May Be Decreased In
RBCs ^b	M: 4.3–5.7 million cells/mm ³ F: 3.8–5.1 million cells/mm ³		Polycythemia, congenital heart disease, pulmonary disease, smoking, dehydration, renal disease with high erythropoietin production	Anemias, hemorrhage, bone marrow failure, erythropoietin deficiency due to renal disease, hemolysis, acute leukemia, malnutrition, multiple myeloma
Hemoglobin ^b	M: 13.5–17.5 g/dL F: 12.0–16.0 g/dL		See RBCs	See RBCs
Hematocrit ^b	M: 39–49% F: 35–45%		See RBCs	See RBC
Platelets	150,000–400,000/mm ³		Polycythemia, leukemia, severe hemorrhage	Thrombocytopenia purpura; aplastic anemia; acute leukemia; acute disseminated intravascular coagulation
WBCs ^c	4500–11,000 cells/mm ³		Leukemia, infections, inflammation, severe burns, severe emotional or physical stress (see differential WBCs)	Autoimmune/collagen vascular disease, 25% with acute leukemia, bone marrow failure, disease of liver or spleen (see differential WBCs)
<i>Differential WBCs</i>				
Neutrophils, segmented (PMNs)	54–62%	3000–5800/mm ³	Acute bacterial infection, inflammatory disease, CML, bone marrow disorders, hemorrhage, diabetic acidosis, glucocorticoid use	Chemotherapy, AA, leukemias, radiation therapy, widespread bacterial or viral infection
Neutrophils, bands	3–5%	150–400/mm ³	Acute bacterial infection acute leukemia, myeloproliferative diseases	CLL

Table 8.5 (Continued)

Blood Cell Type	Normal Reference Range		May Be Increased In	May Be Decreased In
Lymphocytes	23–33%	1 200–3 000/mm ³	CLL, viral infections, radiation therapy, MM	Human immunodeficiency virus infection, lupus, acute leukemia, CML, sepsis, radiation exposure
Monocytes	3–7%	285–500/mm ³	Viral, parasitic infection, inflammatory disorders, tuberculosis, monocytic leukemia, Hodgkin’s disease, lipid storage disease	Leukemia, bone marrow failure
Eosinophils	1–3%	50–250/mm ³	Allergic disorders, CML, parasitic disease, inflammatory disorders, infections, bone marrow disorders, pernicious anemia, collagen vascular disease	
Basophils	0–0.75%	15–50/mm ³	CML, chronic inflammation, hypersensitivity reaction to foods, radiation therapy	Acute allergic reaction

F: female; M: male; Absolute Neutrophil Count (ANC) = WBC × (%PMNs + %Bands).

^a Normal ranges vary with each laboratory.

^b Varies with altitude.

^c WBC normal range for infants (8 000–15 000/mm³) and children age 4–7 years (6 000–15 000/mm³).

Table 9.1 Definitions of Bleeding Disorders

Platelet disorders

Thrombocytopenia

Decreased number of functioning platelets caused by decreased platelet production or accelerated platelet destruction/removal

**Immune
thrombocytopenic
purpura (ITP)**

An autoimmune disorder causing platelet destruction due to the presence of antibodies against the patient's own platelets

**Drug-induced platelet
disorders**

Drugs may reversibly or irreversibly cause inhibition of platelet function

Coagulation disorders

**Von Willebrand disease
(vWD)**

An autosomal dominant hereditary bleeding disorder caused by a deficient or defective plasma von Willebrand factor (vWF)

Hemophilia A

An X-linked genetic disorder resulting in deficient or defective clotting factor VIII

Hemophilia B

An X-linked genetic disorder resulting in deficient or defective clotting factor IX

**Disseminated
intravascular
coagulation**

An acquired coagulation disorder characterized by uncontrolled thrombin activation and release, resulting in severe thrombosis that may be fatal

**Drug-induced
coagulation disorders**

Drugs may prevent synthesis of coagulation cascade factors and have the potential to result in prolonged bleeding



Figure 9.1 Spontaneous gingival oozing in patient with severe thrombocytopenia.

Table 9.2 Clinical Bleeding Symptoms Differ Based on Nature of Hemostatic Disorder

Clinical Findings	Platelet and Vascular Disorders	Coagulation Disorders
Petechiae	Characteristic	Rare
Ecchymoses	Characteristic, usually small and multiple	Common, often large and solitary
Deep dissecting hematomas	Rare	Characteristic
Hemarthroses	Rare	Characteristic
Delayed surgical bleeding	Rare	Common
Bleeding from superficial cuts and scratches	Persistent, often profuse	Minimal

Table 9.3 Common Laboratory Tests Used to Assess Hemostasis

Laboratory Test	Normal Range	What It Measures
Platelet count	150,00–400,00 cells/mL	Platelet quantity
Ivy bleeding time	<6 min	Platelet function (quantity and quality)
PFA-100	Closure time <193 s	Quantitative and qualitative measurement of platelet adhesion, activation, and aggregation
PT	11–145 s	Factors II (prothrombin), V, VII, and X, and fibrinogen
INR	1.0	
aPTT	27–38 s	Factors II, V, VIII, IX, X, XI, and XII
Thrombin time (TT)	9–13 s	Abnormalities in the conversion of fibrinogen to fibrin
Antifactor Xa	0.3–0.7 IU/mL (UH, therapeutic) 0.5–1.2 IU/mL (LMWH, therapeutic)	Plasma UH and LMWH levels

PFA-100: platelet function analyzer 100; UH: unfractionated heparin.

Condition	Platelet Count	Bleeding Time/PFA-100	PT/INR	aPTT	TT	Antifactor Xa
Aspirin therapy	↓ or ↔	↑	↔	↔	↔	↔
Coumarin therapy	↔	↔	↑↑	↑	↔	↓↓
Heparin therapy	↔	↔	↔	↑↑	↑	↓↓
LMWH therapy	↔	↔	↔	↔	↑	↓↓
DTI therapy	↔	↔	↑	↑↑	↑↑	↔
Factor Xa therapy	↔	↔	↑	↑	↔	↓↓
Hemophilia A or B	↔	↔	↔	↑↑	↔	↔
Thrombocytopenia	↓↓	↑↑	↔	↔	↔	↔
Severe liver disease	↓	↑	↑↑	↑↑	↑↑	↓↓
Renal hemodialysis	↓	↔	↔	↑	↔	↑
Leukemia	↓	↑	↔	↔	↔	↔
Vessel wall defect	↔	↑	↔	↔	↔	↔
Fibrinogenolysis	↔	↔	↑	↑	↑↑	↔
DIC	↓↓	↑↑	↑↑	↑↑	↑↑	↓↓

↑: mild increase; ↑↑: moderate to marked increase; ↓: mild decrease; ↓↓: moderate to marked decrease; ↔: normal level;
PFA-100: platelet function analyzer 100; DIC: disseminated intravascular coagulation; DTI: direct thrombin inhibitor.

Ivy Bleeding Time

- The skin is incised and observed for primary hemostasis in a standardized manner.
- A prolonged bleeding time in patients with a platelet count higher than 100,000 cells/mL suggests impaired platelet function.
- This test is a poor indicator of mucosal and oral-surgery-induced bleeding and, therefore, is of limited clinical utility.⁶

Platelet Function Analyzer 100

A prolonged closure time in patients with a platelet count higher than 100,000 cells/mL suggests impaired platelet function.

Liver Function Tests

Some patients with advanced liver disease may present with both quantitative and qualitative platelet disorders in addition to clotting defects.

Any dental treatment performed on patients with advanced liver disease should be done in coordination with a physician

Coagulation Tests

Prothrombin Time/International Normalized Ratio

- PT measures factors of the extrinsic coagulation pathway. A prolonged PT indicates a deficiency or defect.
- It is reported as the INR, which standardizes PT results across laboratories.
- The INR is elevated in patients taking coumarin anticoagulants. Depending on the specific clinical indication for therapy, patients on warfarin are typically maintained between 2.0 and 3.0.
- Indications for anticoagulant therapy include treatment and long-term prophylaxis for DVT as well as prevention of complications associated with prosthetic heart valves, atrial fibrillation, cerebrovascular accident, and post-myocardial infarction. Patients with recurrent DVT and prosthetic heart valves may be maintained at levels up to 3.5.

Activated Partial Thromboplastin Time

- The aPTT measures the factors in the intrinsic and common coagulation pathways. A prolonged aPTT indicates a deficiency or defect.
- This may be utilized to monitor the effects of heparin therapy but not LMWHs.
- This can be used to assess bleeding risk in hemophiliacs since this test includes factors VIII and IX.

Thrombin Time

TT can be prolonged because of hypofibrinogenemia, abnormal fibrinogen (dysfibrinogen), or the presence of inhibitors (fibrin degradation products) that interfere with fibrin polymerization.

Antifactor Xa

The antifactor Xa assay is designed to measure plasma unfractionated heparin and LMWH levels and to monitor anticoagulant therapy.



Figure 9.7 Patient with severe hemophilia A, 4 days postextraction impacted #32 with a “liver” clot which has a liver-like texture and appearance and extrudes from the socket, bleeding easily. It may bleed easily and requires removal by curettage for continued healing, possibly with presurgical factor concentrates, local hemostatics, and Amicar use. The “liver clot,” extruding on to cover some of the occlusal surface of tooth #31, is due to venous bleeding with prolonged oozing and is rich in hemoglobin.

Anemia

Oral lesions may include the following:

1. Pallor—along with pallor of skin, anemic patients may exhibit pallor on the oral mucosa, especially on the floor of the mouth.
2. Petechiae—these are pinpoint erythematous spots on oral mucosa, as a consequence of microhemorrhages under the skin.
3. Mucosal ulcers—vitamin B12-deficiency and iron-deficiency anemia may be accompanied by oral mucosal ulcers.
4. Gingival enlargement and bleeding may occur in patients with AA.
5. Jaundice—hemolysis in patients with hemolytic anemia leads to hyperbilirubinemia.
6. Glossodynia—burning sensation inside the mouth, especially the tongue, is observed in iron-deficiency anemia.
7. Atrophic tongue—depapillation of the dorsal tongue may be a sign of iron-deficiency anemia.
8. Chipmunk facies in individuals with thalassemia major—bimaxillary protrusion and alveolar enlargement contribute to the chipmunk facies appearance of thalassemia major. Alveolar ridge enlargement occurs due to compensatory expansion of the bone marrow.
9. Alveolar bone in patients with SCA exhibits a stepladder pattern radiographically.
10. Generalized radiolucency of the mandible due to marrow hyperplasia in SCA.

Susceptibility to Infection

**TABLE 2.5 Reported Frequency of
Bacteremia Associated With
Various Dental Procedures and
Oral Manipulation**

Dental Procedure or Oral Manipulation	Reported Frequency of Bacteremia (%)
Tooth extraction	10–100
Periodontal surgery	36–88
Scaling and root planing	8–80
Teeth cleaning	≤40
Rubber dam matrix or wedge placement	9–32
Endodontic procedures	≤20
Toothbrushing and flossing	20–68
Use of wooden toothpicks	20–40
Use of water irrigation devices	7–50
Chewing food	7–51

Infective endocarditis

blood culturing

complete blood count with differential

electrolyte panel

renal function tests

Urinalysis(microscopic hematuria and proteinuria)

normocytic, normochromic anemia

The white blood cell (WBC) count may or may not be elevated.

Other abnormal findings may include

- an elevated erythrocyte sedimentation rate

- increased immune globulins

- circulating immune complexes

- positive rheumatoid factor.



Figure 5.7 Gingival enlargement in the maxillary anterior area secondary to cyclosporine for immunosuppression in a kidney transplant patient.

BOX 14.3 Early Clinical Manifestations of Diabetes

Type 1

- **Cardinal signs and symptoms (common):** polydipsia, polyuria, polyphagia, weight loss, loss of strength
- **Other signs and symptoms:** recurrence of bed wetting, repeated skin infections, marked irritability, headache, drowsiness, malaise, dry mouth

Type 2

- **Cardinal signs and symptoms (much less common):** polydipsia, polyuria, polyphagia, weight loss, loss of strength
- **Frequent signs and symptoms:** slight weight loss or gain, gastrointestinal upset, nausea, urination at night, vulvar pruritus, blurred vision, decreased vision, paresthesias, dry flushed skin, loss of sensation, impotence, postural hypotension

Diabetes mellitus

Oral manifestations include:

- ☐ Xerostomia
- ☐ burning mouth (possibly due to neuropathy)
- ☐ delayed wound healing
- ☐ increased incidence and severity of infections
- ☐ enlargement of parotid salivary glands
- ☐ gingivitis
- ☐ periodontitis



Figure 4.1 Oral signs of undiagnosed/uncontrolled diabetes mellitus: (a) xerostomia; (b) chronic candidiasis; (c) multiple periodontal abscesses; (d) severe periodontal disease (*Continued*);

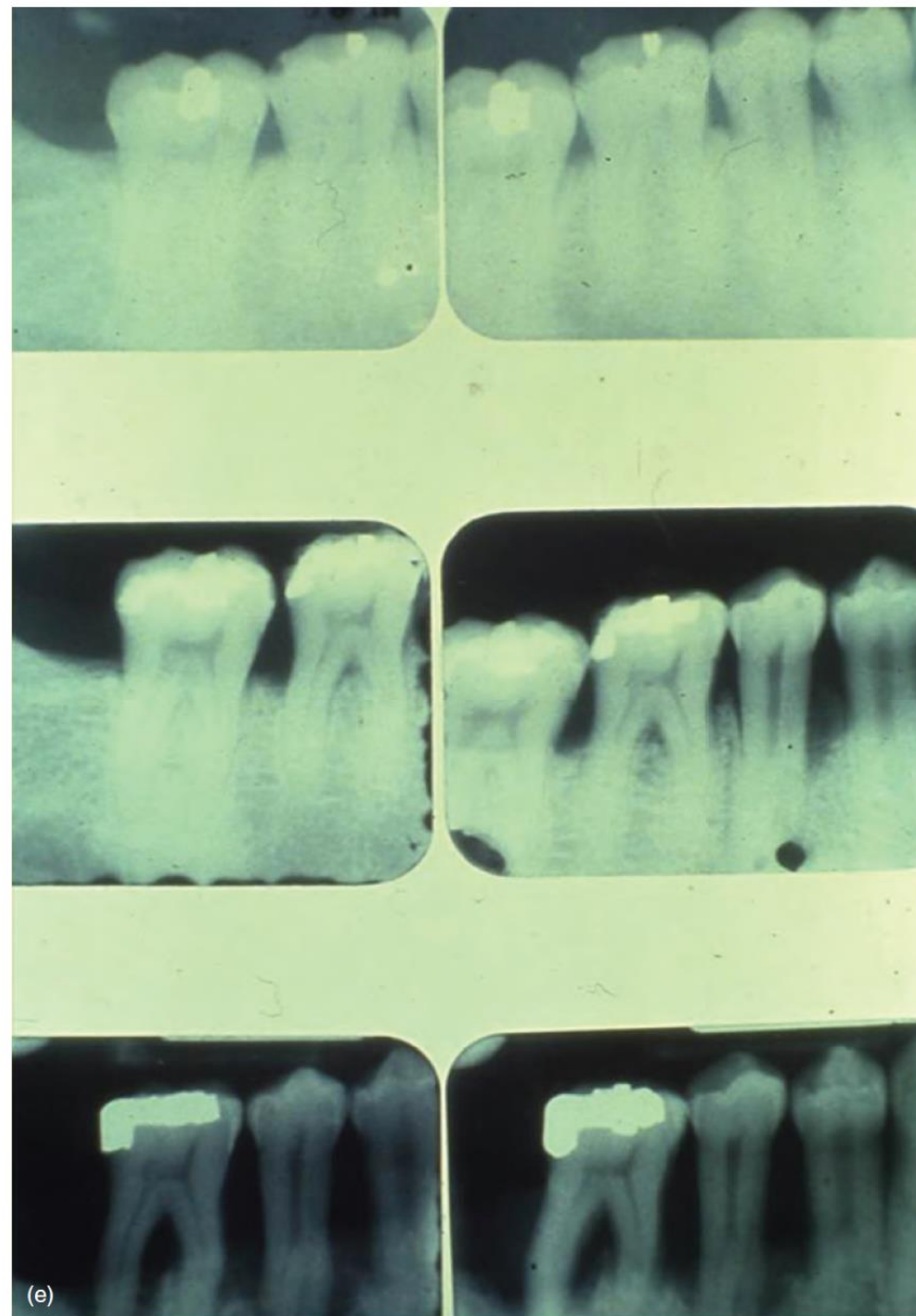


Figure 4.1 (Continued) (e) rapidly progressive alveolar bone loss over a 2-year period.

TABLE 14.3 Diagnostic Criteria for Diabetes Mellitus*

- 1.** FPG ≥ 126 mg/dL (≥ 7.0 mmol/L) on two occasions. Fasting is defined as no caloric intake for at least 8 hours. This fasting glucose value is consistently associated with the risk for retinopathy.
- or
- 2.** Symptoms and signs of diabetes plus casual (random) plasma glucose concentration ≥ 200 mg/dL (11.1 mmol/L). *Casual* is defined as obtained at any time of day without regard to time since last meal. Many patients do not have obvious symptoms. The cardinal manifestations of diabetes include polyuria, polydipsia, and unexplained weight loss.
- or
- 3.** 2-Hour postload glucose ≥ 200 mg/dL (≥ 11.1 mmol/L) during an OGTT. The test should be performed as described by the WHO using a glucose load containing the equivalent of 75 g of anhydrous glucose dissolved in water.*
- or
- 4.** Glycosylated hemoglobin (by A_{1c} assay) $\geq 6.5\%$

*Oral glucose tolerance testing (OGTT) generally is not recommended in clinical practice.

FPG, Fasting plasma glucose; WHO, World Health Organization.

HIV infection

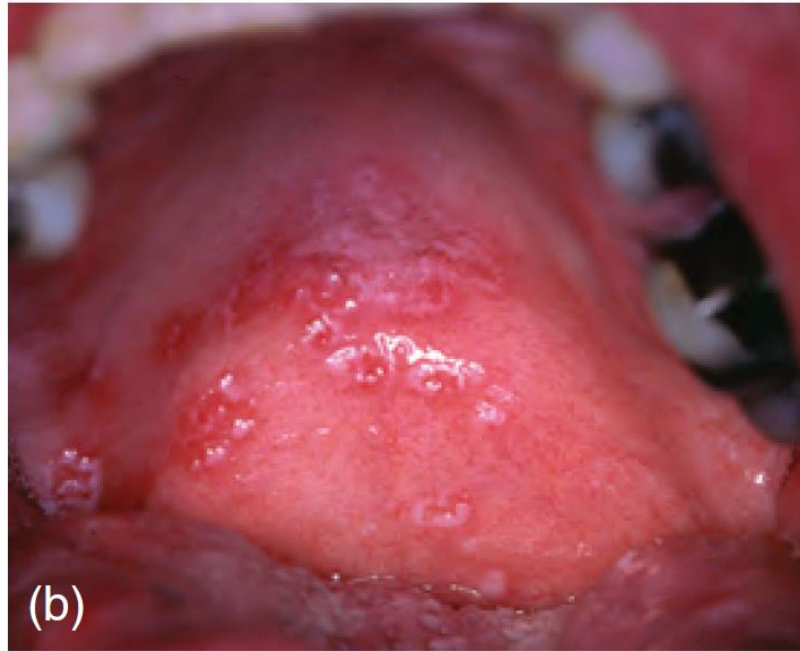


Figure 11.2 Pseudomembranous candidiasis of the (a) buccal mucosa, (b) palate, and (c) ventral tongue.



Figure 11.4 Oral hairy leukoplakia of the left tongue.



Figure 11.5 Nodular Kaposi's sarcoma of the palate.



Figure 11.6 Oral wart on (a) the tongue and (b) lower lip.



Figure 11.7 Necrotizing ulcerative gingivitis (maxillary arch) and necrotizing ulcerative periodontitis (mandibular arch).



Figure 11.8 Herpes simplex virus infection (herpes labialis) at labial commissure.



Figure 11.9 Major aphthous ulcers of (a) the tongue and (b) upper labial mucosa.

- ❑ **Enzyme-linked immunosorbent assay** and enzyme immunoassay (EIA). They are 99% sensitive but generate a number of false positives.
- ❑ The more specific **Western blot** or indirect immunofluorescence assay has been used for confirmation but may produce **false-negative results early in infection**. Thus, positive enzyme-linked immunosorbent assay and negative or indeterminate Western blot/indirect immunofluorescence assay results require HIV-1 nucleic acid testing for resolution.
- ❑ It is important to remember that seroconversion (positive HIV antibody test) may not occur for up to **6 months** following exposure and infection.

In patients who are HIV positive, routine hematological tests are often assessed, which include:

- total white blood cell count;
- differential white blood cell count, including absolute neutrophil count;
- hematocrit and hemoglobin;
- platelet count.

While all values may be suppressed, particularly in advanced AIDS, it is rare that the values are suppressed to critical levels that would require medical management or transfusion prior to dental surgical procedures.

The current US standard conventional testing recommendation is use of the new fourth-generation combination HIV-1 p24 antigen and HIV-1/HIV-2 antibody (Ag/Ab) tests with serum or plasma specimens that allow identification of acute or primary HIV infection by detecting HIV-1 p24 antigens **within 2–4 weeks of exposure.**

CD4+ Lymphocyte Counts

Normal range, 500–1500 cells/ μ L of blood; median, 1000 cells/ μ L:

- This is the most widely available **marker of immune system competence** in the patient with HIV/AIDS.
- It is an excellent predictor of pending **risk of HIV-associated opportunistic infection, disease progression, and survival**.
- Low CD4 counts have been associated with development of many of the oral manifestations of HIV infection.
- This guides the prophylactic use of antimicrobial medications to prevent the appearance of HIV opportunistic infections.
- Initial immune suppression (CD4 <500 cells/ μ L) signals the first appearance of systemic and oral opportunistic infections.
- Severe immune suppression (CD4 <200 cells/ μ L) predisposes patients to life-threatening infections (e.g., toxoplasmosis and cryptococcosis).
- CD4+ counts may be obtained at entry to care and every 3–6 months or more frequently if a patient is altering the ART regimen or has new clinical signs or symptoms.

Hepatic disease

Table 6.1 Characteristics of Hepatitis Viruses: Pathogenesis/Etiology/Disease Course

	HAV	HBV	HCV	HDV	HEV
Classification	Picornavirus	Hepadnavirus	Flaviviridae family	Small defective RNA virus, infects with HBV	Calicivirus or alpha-virus family
Mode of transmission	Fecal–oral <i>Rarely:</i> percutaneous	Percutaneous, sexual, perinatal	Percutaneous <i>Rarely:</i> sexual, perinatal	Percutaneous, sexual, perinatal	Fecal–oral
Prophylaxis	Ig, vaccine	HBIG, vaccine	None	None (HBV vaccine for susceptible)	None
Incubation (days)	15–50	30–180	15–160	21–140	14–63
<i>Clinical features</i>					
Chronic infection	No	1–10%, up to 90% in neonates	80–90%	Common	No
Carrier state	No	Yes	Yes	Yes	No
Severity of symptoms	Usually mild, age-dependent	Moderate	Asymptomatic to mild	May be severe	Usually mild
Fulminant hepatitis	<0.1%	1%	Rare	Up to 20% in superinfection	10–20% in pregnant women
Hepatocellular carcinoma	No	Yes	Yes	?	No

Source: Adapted from Harrison's Manual of Medicine; Fauci AS, Braunwald E, Kasper DL, et al. eds. 2009.²
Ig: immunoglobulin.

Hepatitis A Virus

- HAV immunoglobulin M (IgM) test (preferred confirmatory test for acute HAV infection).
 - Serum antibodies IgM usually can be detected 5–10 days before symptom onset, and the level remains elevated for 4–6 months.
- Elevated liver enzymes.
- Elevated bilirubin levels.

Hepatitis B Virus

- Hepatitis B surface antigen (HBsAg).
 - Indicates currently infectious, with acute or chronic infection.
- Hepatitis B surface antibody (HBsAb).
 - Indicates recovery or successful immunization.
- Hepatitis B core antibody (HBcAb).
 - Indicates previous or ongoing infection.
- IgM antibody to HBc antigen (IgM anti-HBc).
 - Indicates acute infection, acquired in the last 6 months.

Hepatitis C Virus

- Enzyme immunoassay to detect antibodies to multiple HCV antigens.
- Hepatitis C RNA virus by polymerase chain reaction (PCR) detects quantity of the virus itself in the blood (quantification of the virus).

Alcoholic Liver Disease

Rather than being caused singularly by ethanol toxicity in hepatocytes, ALD is currently considered to be a multifactorial disease, where gender, genetic, and nutritional factors influence the disease progression to cirrhosis.

Alcohol can sometimes impair **platelet function**, with an effect that is proportional to the degree of alcohol ingestion.

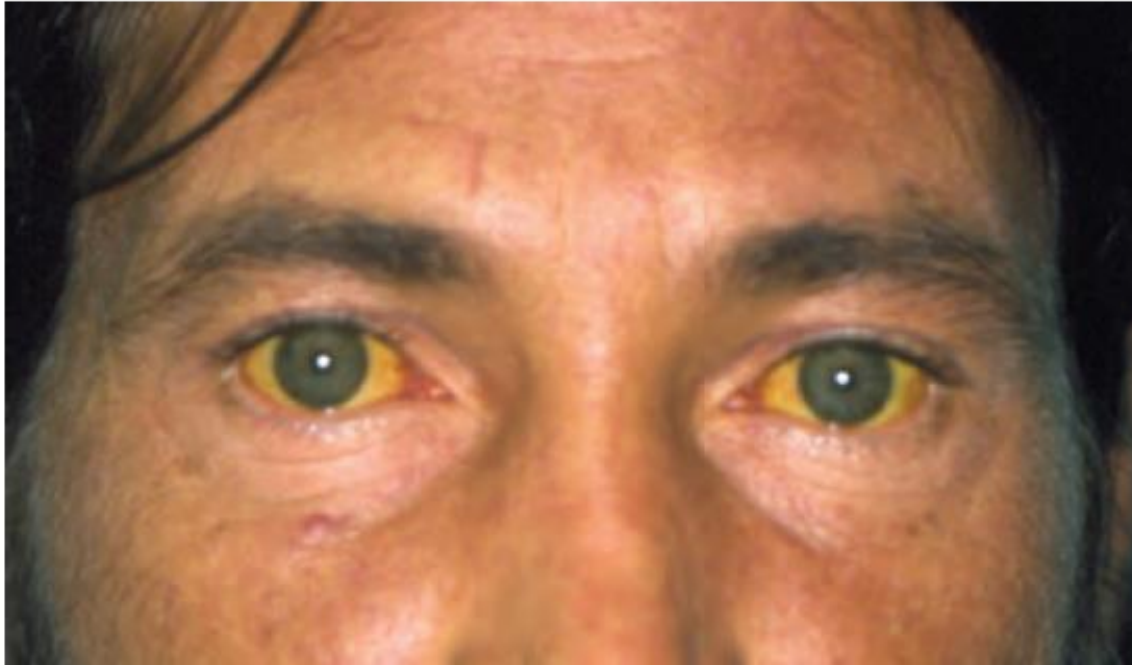


Figure 6.1 Jaundiced skin and sclera in a 39-year-old with end-stage alcoholic cirrhosis.



Figure 6.2 Severe intraoral spontaneous bleeding in a patient with end-stage cirrhosis.

Liver Enzymes

- Aspartate aminotransferase or serum glutamic-oxaloacetic transaminase; normal range: 5–40 units/L serum.
- Alanine aminotransferase or serum glutamicpyruvic transaminase; normal range: 7–56 units/L serum.

Abnormal bleeding is associated with hepatitis and cirrhosis/end-stage liver disease.

Vitamin-K-dependent clotting factors II, VII, IX, and X are synthesized in the liver, and the production is affected in patients with severe liver disease. Factors I and V are also affected.

Additionally, **thrombocytopenia** could be present in patients with splenomegaly associated with chronic liver disease.

Before surgical procedures, patients with liver disease must have a careful evaluation of their capacity for hemostasis, and testing should include at minimum a **platelet count, PT/INR, and PTT tests**.

The patient with viral hepatitis being actively treated with interferon may have **neutropenia** and warrant antibiotic prophylaxis.

Tuberculosis

- Active TB disease

general malaise

weakness

weight loss

Fever

night sweats

lymphadenopathy

- Pulmonary TB disease

chronic cough (present for more than 3 weeks)

chest pain

Hemoptysis

Microscopic identification of acid-fast bacilli (AFB) in sputum sample is used to determine if a patient is infectious.

In order for a patient to be considered cured or noninfectious, there must be three consecutive AFB-negative sputum smears.

- Mantoux TST: the most useful and reliable method of determining infection.
 - Intradermal injection of 0.1 mL of tuberculin purified protein derivative usually on the inside of the forearm.
 - Skin reaction is measured in millimeters of induration (not erythema) 48–72 h after administration.
 - A positive test depends on this measurement and the person's risk factors for TB.
- For a person with no known risk factors, the induration must measure ≥ 15 mm, while HIV-positive patients or those in recent contact with a person with TB disease only need a 5 mm reaction.
-
- Interferon-gamma release assays: whole blood tests that measure a person's immune reactivity to M. tuberculosis; for example, QuantiFERONE® Gold In-Tube test (QFTGIT; Cellestis Inc., Valencia, CA).
 - Not widely used because of their expense.
 - Useful to screen patients with a history of receiving the bacilli Calmette–Guerin (BCG) vaccine.
 - Previous vaccination with the BCG vaccine can cause a false-positive TST but does not affect the results of the QFT-GIT.

Comparison of latent and active TB

LTBI

TB disease

M. tuberculosis in the body

Tuberculin skin test (Mantoux purified protein derivative) usually positive and:

Chest X-ray normal

Chest X-ray abnormal

Sputum/smear/culture
negative

Sputum/smear/
culture may be
positive

No symptoms

Symptoms

Not infectious; has
inactive TB bacteria

Infectious; has active
TB bacteria

Needs preventive
treatment in order
to prevent active TB
disease

Needs treatment
to treat active TB
disease

Adrenal Insufficiency

- ❑ *Primary adrenal insufficiency (AI), or Addison's disease*
- ❑ *Secondary AI* results when the hypothalamic–pituitary axis fails to produce sufficient quantities of ACTH (corticotrophin).
- ❑ *Tertiary AI* results from impaired release or action of corticotrophic-releasing hormone from the hypothalamus, leading ultimately to adrenal atrophy.
- ❑ *Acute AI (adrenal crisis)* may manifest as progressive adrenal failure usually occurring in association with a physically or emotionally stressful event.

Signs and symptoms of adrenal failure

- Hypotension
- Lethargy
- Nausea and vomiting
- Abdominal pain
- Hypoglycemia
- Hypovolemic shock
- Coma and death
- Headache
- Confusion
- Syncope
- Fever
- Seizures
- Cardiovascular collapse

Common signs of chronic AI include

- ☐ **Oral mucosal hyperpigmentation:** The oral cavity in patients with chronic AI may present with bluish-black mottling of oral mucosa, palate, and lips.
- ☐ **Chronic glucocorticoid therapy may predispose to oral candidiasis or recurrent oral herpes.**
- ☐ **Bronzecolored hyperpigmentation of the skin, most noticeable on sun-exposed body surfaces.**
- ☐ **weakness**
- ☐ **Fatigue**
- ☐ **Hypotension**
- ☐ **especially orthostatic hypotension**
- ☐ **Insufficiency of aldosterone may result in loss of extracellular fluid volume leading to compensatory loss of plasma from blood vessels (hypovolemia)**
- ☐ **an increase in total body potassium (hyperkalemia), and acidosis**

Signs and symptoms of Cushing's syndrome

- Upper body obesity, thin limbs, and buffalo hump
- Round, red, full face (moon face)
- Easy bruising
- Bone pain, multiple fractures
- Muscle weakness
- Women, facial hirsutism, irregular menstruation

Cautions in Cushing's syndrome

- ☐ Glucocorticoids use
- ☐ Angioedema
- ☐ moon face
- ☐ oral candidiasis
- ☐ oral herpes simplex virus
- ☐ **anemia**
- ☐ **Neutropenia**
- ☐ possible adrenal suppression

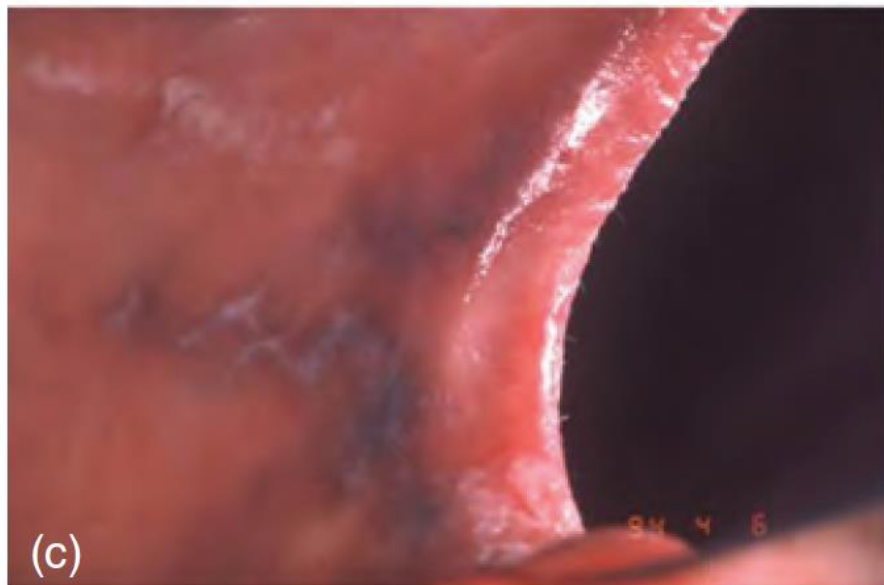
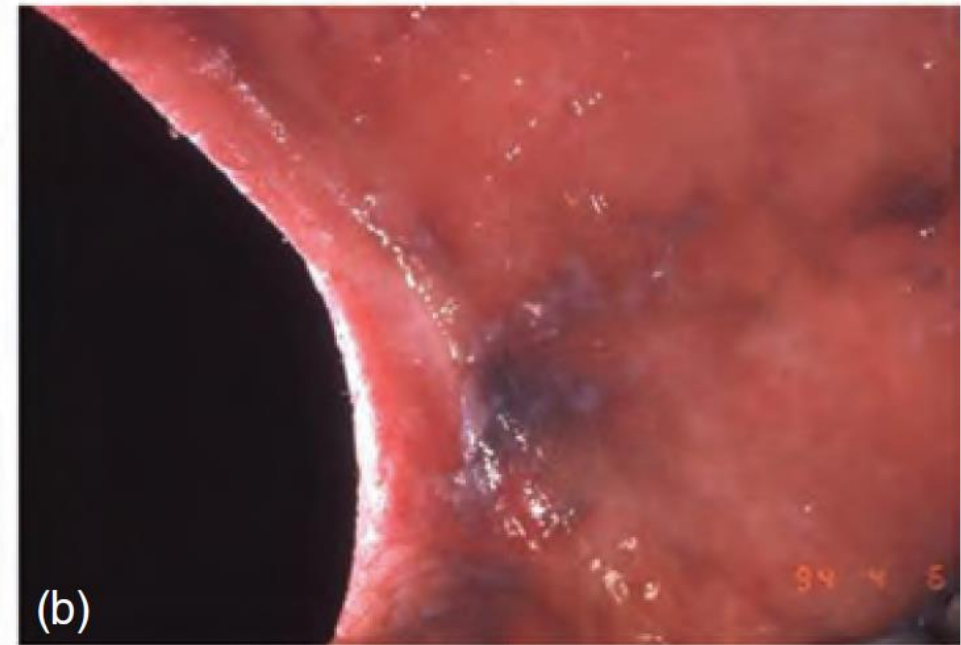


Figure 4.2 Composite view of AI-associated oral hyperpigmentation.



Figure 3.4 Oral candida infections from steroid inhaler.

Lab tests

- ❑ random plasma cortisol levels →→ identify individuals who require further adrenal function evaluation.
- ❑ Plasma ACTH levels
- ❑ ACTH-stimulating tests
- ❑ anti-adrenal antibodies

Thyroid gland disorders

Table 4.7 Characteristics of Thyroid Diseases

Category	Hypothyroidism	Hyperthyroidism
General	Weakness, lethargy, hoarse voice, weight gain, chronic constipation	Fatigue and weakness
Metabolic	Cold intolerance, decreased basal metabolic rate, weight gain	Heat intolerance, increased appetite, weight loss
Central nervous system	Slurring of words, sleep apnea, decreased concentration, mental slowness	Tremor, emotional lability, nervousness, sleep disturbances
Skin	Decreased sweating, coarse hair, nonpitting edema (myxedema)	Excessive perspiration, warm moist skin, fine hair or alopecia
Cardiac/pulmonary	Dyspnea, bradycardia, diastolic hypertension	Dyspnea, palpitations and tachycardia (associated with widened pulse pressure)
Other	Macroglossia, salivary gland enlargement, xerostomia, muscle cramps and pain Cretinism and dental anomalies (children)	Menstrual dysfunction, enlargement of thyroid gland, proptosis or exophthalmos

Hyperthyroidism

- An occasional ectopic lingual thyroid nodule or tumor may occur in the posterior dorsum of the tongue.
- Chronic thyrotoxicosis may be associated with an increased risk of **osteoporosis**, which may have an effect on the incidence and severity of **periodontal disease**.
- Dental **caries** has been reported to occur more frequently.
- Development of the teeth and jaws may be accelerated, and **premature loss** of deciduous dentition may occur.

Hypothyroidism

- Untreated neonatal hypothyroidism may result in altered development of the jaws **delayed tooth eruption**, malocclusion, **thick lips**, and a **protruding tongue**.
- In older children and adults, uncontrolled hypothyroidism may be associated with **macroglossia**, **glossitis**, **salivary gland enlargement**, and increased risk for dental **caries** and **periodontal** diseases.
- Treatment of hypothyroidism has been of occasional benefit in managing **burning mouth syndrome**.
- An association between oral lichen planus and hypothyroidism has been reported.



Figure 4.3 Permanent exophthalmos in an individual successfully treated for Graves' disease.

Table 4.6 Hormones Secreted by the Thyroid and Their Normal Ranges

Hormone/Test	Normal Range	Function
T4	4.5–11.2 µg/dL	This iodine-rich hormone is primarily protein bound in blood, and it acts as a prohormone for triiodothyronine (T3).
T3	100–200 ng/dL	T3 is largely free in blood and four times more active in life functions than T4.
Calcitonin	<10 pg/mL	Calcitonin interacts with parathyroid hormone to regulate serum calcium and phosphorus levels.

Hyperthyroidism

TSH and/or T4 may be the first indication that an abnormality is present

- ☐ T3 is also often elevated.
- ☐ low TSH level
- ☐ high free T4 concentration

Kidney failure

- ❑ serum creatinine (the breakdown product of creatine phosphate in muscle that ends up in blood),
- ❑ Creatinine clearance
- ❑ BUN (BUN is the waste product of protein metabolism),

Progressive reduction in creatinine clearance is a direct reflection of diminishing renal capacity.

The BUN level is also a reflection of renal function and increases during progressive renal failure.

- ❑ **Chronic anemia** due to the inability of the kidney to produce sufficient erythropoietin (EPO) to stimulate bone marrow production of red blood cells.
- ❑ Patients with CKD usually have qualitative and quantitative **platelet deficiencies**.
 - ✓ platelet count
 - ✓ prothrombin time/international normalized ratio
 - ✓ partial thromboplastin time
- ❑ Abnormalities such as metabolic acidosis, fluid overload, and hyperkalemia can exist.
Measurement of **serum electrolytes**

Table 5.2 Serum Chemistry Laboratory Changes in CKD

Laboratory Test	Normal Range	Normal Values in CKD	Signs/Symptoms of Abnormality
Serum creatinine	0.7–1.4 mg/dL	Increased generally 12–20 mg/dL (depends on muscle mass)	Fatigue, dehydration, mental confusion, shortness of breath
BUN	7–21 mg/dL	Increased, but <100 mg/dL (depends on protein intake)	Fatigue, insomnia, nausea, dry or itching skin, urine-like body odor and breath
Creatinine clearance	85–150 mL/min	<10 mL/min	
Serum calcium (Ca ²⁺)	8.5–10.5 mg/dL	Same, but goal is <10 mg/dL	<i>Low:</i> cataracts; depression; hair loss; muscle twitching/cramping; seizures <i>High:</i> fatigue; muscle weakness; mental changes; thirst
Serum phosphorus (PO ₄)	2.5–4.5 mg/dL	Increased, but goal 3.5–5.5 mg/dL	<i>High:</i> causes elevated PTH by lowering Ca ²⁺ ; bone fractures
Serum sodium (Na ⁺)	135–145 mmol/L	Same–decreased	Thirst resulting in drinking more with fluid gain, elevated blood pressure, shortness of breath
Serum potassium (K ⁺)	3.6–5.0 mEq/L	Same–increased, but <6.0 mEq/L	Few until >7 mEq/L, then weakness preceding cardiac arrest
Serum chloride (Cl ⁻)	95–108 mEq/L	Same	<i>Low:</i> hyperexcitable nervous system, low blood pressure, shallow breathing, tetany <i>High:</i> deep breathing, fatigue, muscle weakness
Serum albumin	3.5–5.0 g/dL	Goal >4.0 g/dL	Weight loss, poor appetite, medication side effects
PTH level	10–65 pg/mL	Stage 3: 35–70 pg/mL Stage 4: 70–110 pg/mL Stage 5: 150–300 pg/mL	<i>Early:</i> asymptomatic <i>Late:</i> itching, bony changes on X-ray, fractures



Figure 5.4 Panoramic radiograph showing “ground glass” appearance of renal osteodystrophy in a 44-year-old woman with 10-year history of CKD due to focal segmental glomerulosclerosis on HD.

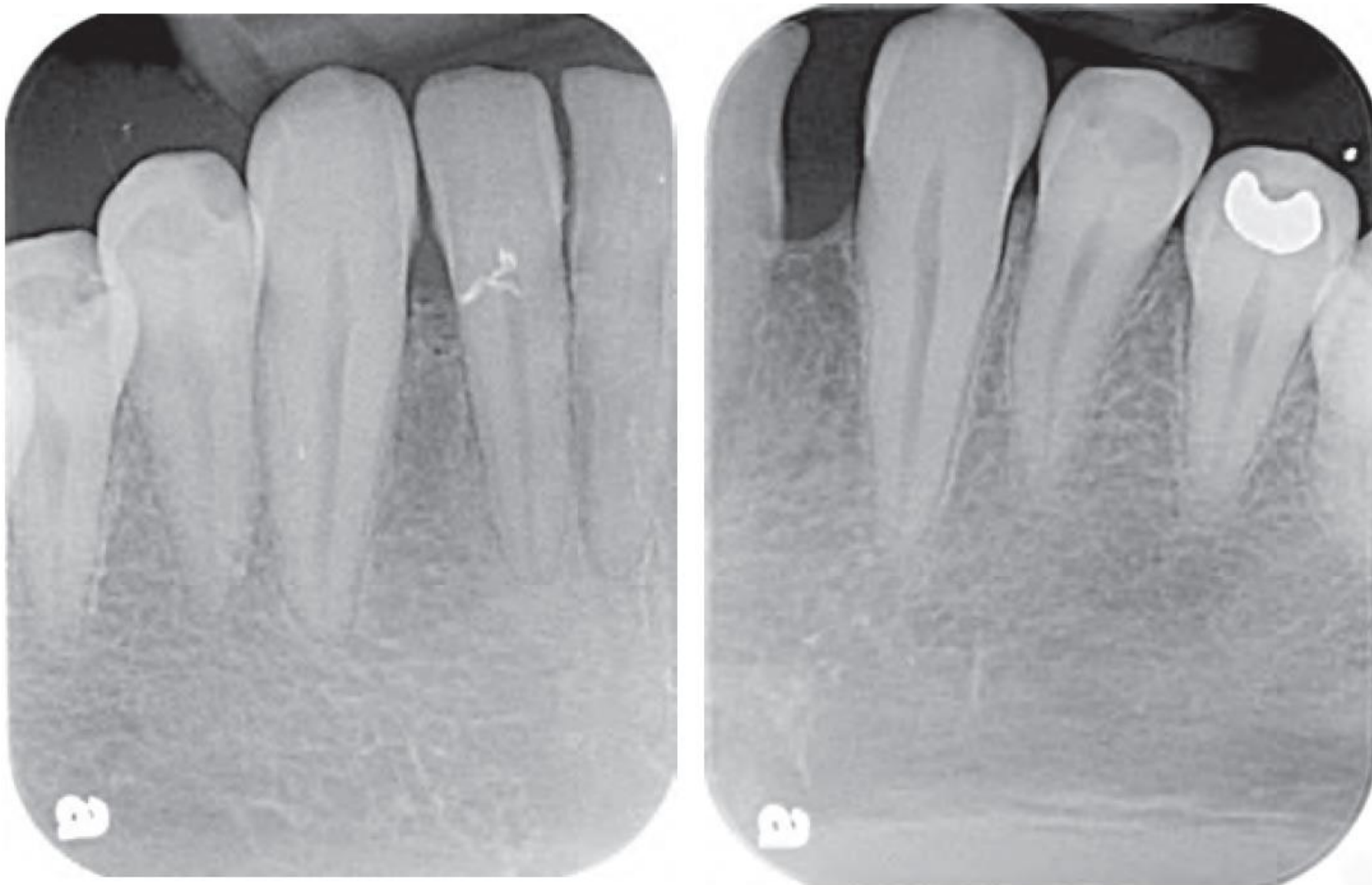


Figure 5.5 Periapical radiographs showing loss of lamina dura and “ground glass” appearance of renal osteodystrophy in a 36-year-old male with type 1 diabetes and ESRD on HD awaiting a kidney/pancreas transplant.

Leukemia, Anemia, and Lymphoma

- ☐ Laboratory testing ranges from blood tests, such as
- ☐ CBC with differential blood smears,
- ☐ Bone marrow biopsy
- ☐ immunotyping, cytogenetic studies
- ☐ lymph node biopsies
- ☐ chest radiographs



Figure 8.6 Gingival erythema and enlargement in a leukemic patient.



Figure 8.5 Mucosal ulcer in a leukemic patient.



Figure 8.7 Intraoral herpetic infection in a leukemic patient.



Figure 8.9 Gingival inflammation/hyperplasia and candidiasis due to leukopenia in a patient with AA.

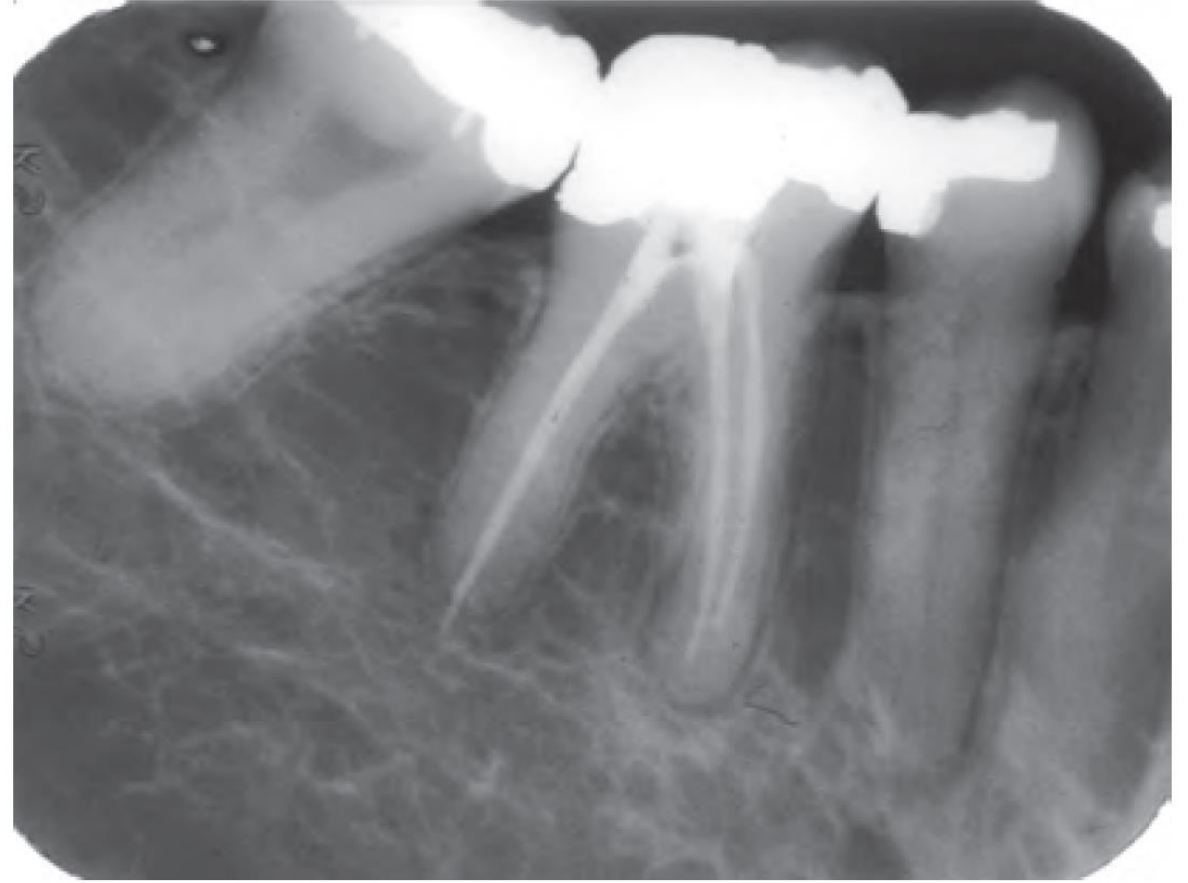
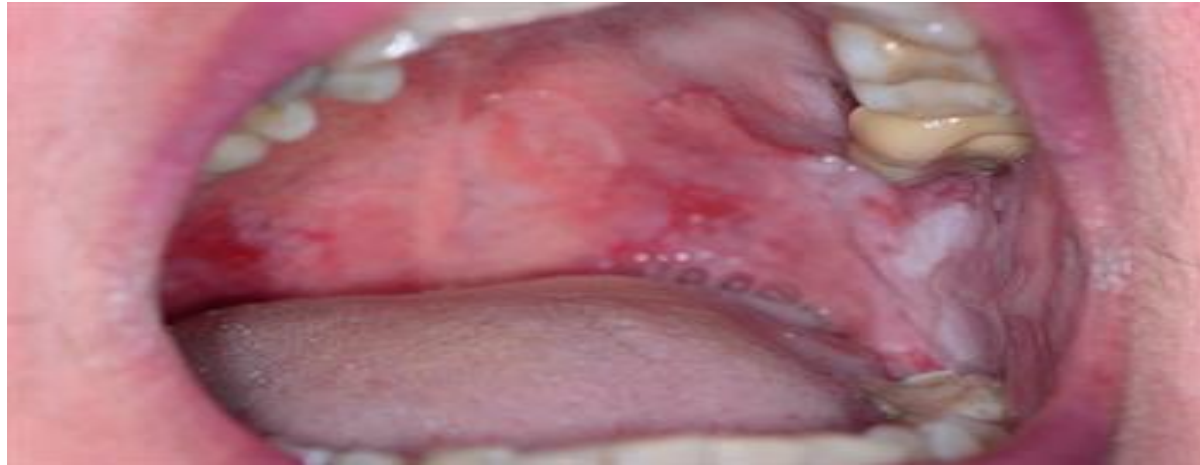


Figure 8.10 Periapical film showing stepladder appearance of alveolar bone due to compensatory marrow expansion in a patient with SCA.

Case1

A 45-year-old woman with history of pemphigus vulgaris



Long term oral corticosteroids

- ☐ Elevated pressure in the eyes (glaucoma)
- ☐ Clouding of the lens in one or both eyes (cataracts)
- ☐ A round face (moon face)
- ☐ High blood sugar, which can trigger or worsen diabetes
- ☐ Increased risk of infections, especially with common bacterial, viral and fungal microorganisms
- ☐ Thinning bones (osteoporosis) and fractures
- ☐ Suppressed adrenal gland hormone production that may result in a variety of signs and symptoms, including severe fatigue, loss of appetite, nausea and muscle weakness
- ☐ Thin skin, bruising and slower wound healing

Case2

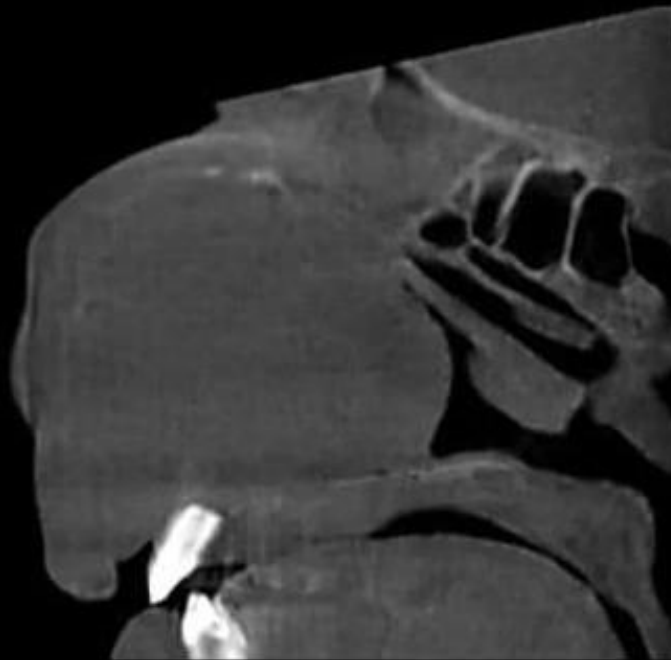
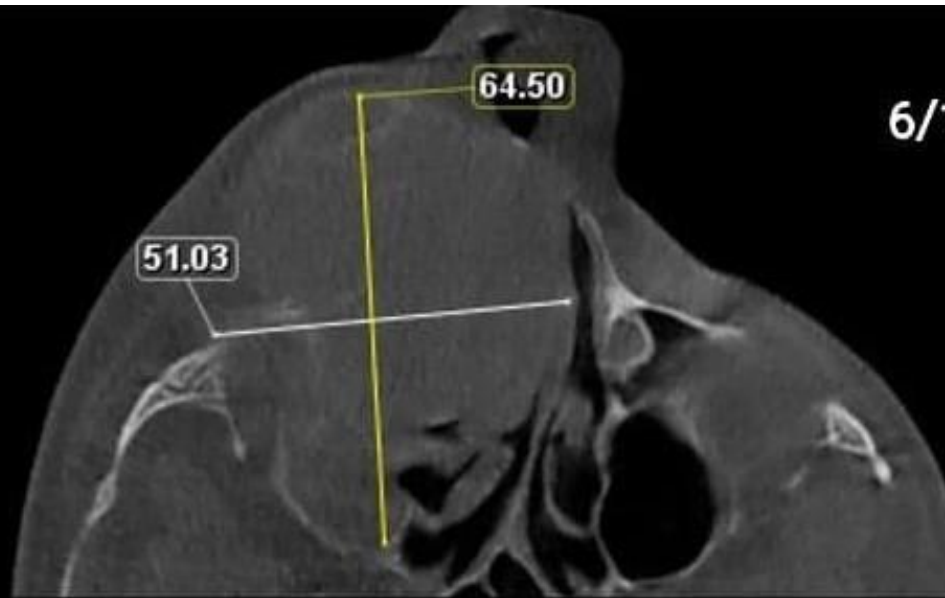
A 39-year-old woman with history of fatigue, loss of appetite and muscle weakness.



Case3

A 47-year-old woman with large maxillary lesion





Biochemistry

<u>Test</u>	<u>Result</u>	<u>Risk</u>	<u>Unit</u>	<u>Reference Range</u>
Calcium	11.7 *	H	mg/dL	8.2 - 10.7
Phosphorus	1.2 *	L	mg/dL	2.6 - 4.5
Alkaline Phosphatase	735	H	U/L	30 - 104

* = The results were rechecked. If clinically not expected, It is recommended to repeat the Test.

Special Biochemistry

<u>Test</u>	<u>Result</u>	<u>Risk</u>	<u>Unit</u>	<u>Reference</u>
Vitamin D (CLIA)	23.0		ng/mL	Deficient : Insufficient : sufficient : Potential

Hormone Analysis

<u>Test</u>	<u>Result</u>	<u>Risk</u>	<u>Unit</u>	<u>Reference</u>
TSH (CLIA)	1.51		micIU/ml	0.3 - 4.84
PTH (CLIA)	778	H	pg/ml	12 - 65

	Possible Causative Medical Disease or Therapy
Dry mucosa	Drug-induced xerostomia, salivary hypofunction from Sjogren's syndrome, diabetes or head and neck cancer radiation therapy
Gingival overgrowth	Leukemia, drug induced (phenytoin, cyclosporine, calcium-channel blockers)
Hard tissue enlargements	Neoplasm, acromegaly, Paget's disease, hyperparathyroidism
Mucosal discoloration of hyperpigmentation	Addison's disease, lead poisoning, liver disease, melanoma, drug induced (e.g., zidovudine, tetracycline, oral contraceptives, quinolones)
Mucosal erythema and ulceration	Cancer chemotherapy, uremic stomatitis, autoimmune disorders (systemic lupus, Bechet's syndrome), vitamin deficiency, Celiac disease, Crohn's disease, drug induced, self-injurious behavior
Mucosal pallor	Anemia, vitamin deficiency
Nondental source oral/jaw pain	Referred pain (e.g., cardiac, neurologic, musculoskeletal), including myofascial and temporomandibular joints; drug induced (e.g., vincristine chemotherapy); primary neoplasms; cancer metastases; sickle cell crisis pain; primary or secondary neuropathies
Opportunistic infections	Immune suppression from HIV, cancer chemotherapy, hematologic malignancy; primary immune deficiency syndromes; poorly controlled diabetes; stress
Oral malodor	Renal failure, respiratory infections, gastrointestinal conditions
Osteonecrosis	Radiation to the jaw; current or prior use of antiresorptive agents such as bisphosphonates or receptor activator of NFκB ligand inhibitors, and certain cancer antiangiogenic agents
Poor wound healing	Immune suppression from HIV, cancer chemotherapy, primary immune deficiency syndromes; poorly controlled diabetes; malnutrition; vitamin deficiency
Soft tissue swellings	Neoplasms, amyloidosis, hemangioma, lymphangioma, acromegaly, interpersonal violence or accidental trauma
Trismus	Neoplasm, post-radiation therapy, arthritis, post-traumatic mandible condyle fracture

Possible Causative Medical Disease or Therapy

Facial Signs

Cachexia	Wasting from cancer, malnutrition, HIV/AIDS
Cushingoid facies	Cushing syndrome, steroid use
Jaundiced skin/sclera	Liver cirrhosis
Malar rash	Systemic lupus erythematosus
Ptosis	Myasthenia gravis
Taught skin and microstomia	Scleroderma, facial burns
Telangiectasias	Liver cirrhosis
Weak facial musculature	Neurologic disorder, facial nerve palsy, tardive dyskinesia, myasthenia gravis

Oral Signs

Bleeding, ecchymosis, petechiae	Thrombocytopenia, thrombocytopathy, hereditary coagulation disorder, liver cirrhosis, aplastic anemia, leukemia, vitamin deficiency, drug induced
Burning mouth/tongue	Anemia, vitamin deficiency, candida infection, salivary hypofunction, primary or secondary neuropathy
Dentoalveolar trauma	Interpersonal violence, accidental trauma, seizure disorder, gait/balance instability, alcoholism
Droling	Neoplasm; neurologic: amyotrophic lateral sclerosis, Parkinson's disease cerebrovascular accident, cerebral palsy; medications (e.g., tranquilizers, anticonvulsants, anticholinesterases)

Dental Signs

Early loss of teeth

Neoplasms, nutritional deficiency (e.g., hypophosphatemic vitamin D resistant rickets, scurvy), hypophosphatasia, histiocytosis X, Hand–Schuller–Christian disease, Papillon–Lefèvre syndrome, acrodynia, juvenile-onset diabetes, immune suppression (e.g., cyclic neutropenia, chronic neutropenia), interpersonal violence or other traumatic injury, radiation therapy to the jaw, dentin dysplasia, trisomy 21–Down syndrome, early-onset periodontitis

Rampant dental caries

Salivary hypofunction from disease (e.g., Sjögren’s syndrome), post-radiation, or xerogenic medications; illegal drug use (e.g., methamphetamines); inability to cooperate with oral hygiene and diet instructions

Tooth discoloration

Genetic defects in enamel or dentin (e.g., amelogenesis imperfecta, dentinogenesis imperfect), porphyria, hyperbilirubinemia, drug induced (e.g., tetracycline)

Tooth enamel erosion

Gastroesophageal reflux disease (GERD), bulimia nervosa

Table 1.3 Dental Radiographic Signs Suggestive of Medical Disease or Therapy

Dental Radiographic Signs	Possible Causative Medical Disease or Therapy
Carotid artery calcification	Carotid arteritis, stroke or transient ischemic attack-related disease, hypertension, hyperlipidemia, heart disease
Condyle/temporomandibular joint articular space destruction	Rheumatoid arthritis, osteoarthritis
Marrow hyperplasia, increased spacing of bony trabeculae, generalized radiolucency	Sickle cell anemia, osteopenia, osteoporosis, malnutrition, secondary hyperparathyroidism from renal disease or renal osteodystrophy
Marrow hypoplasia, generalized increased density or radiopacity	Osteopetrosis, Paget disease, hypoparathyroidism
Reduced cortical bone density	Primary hyperparathyroidism
Resorption of angle of the mandible	Scleroderma
Well-defined radiolucencies not associated with teeth	Neoplasms, multiple myeloma, metastatic cancer