Textbook of Oral Medicine and Radiology

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to

all my beloved
students and dental professionals

Foreword

Oral medicine and radiology was started as a new speciality in India in the early 1970s, by starting MDS in Bangalore and Ahmedabad. Soon, the Dental Council of India made it a separate subject of study and examination for the BDS course in the final year. Before this era, textbooks used by the students were either on oral medicine or radiology, published from abroad. Towards the end of the last century, textbooks on oral medicine and radiology by Indian authors dealing with all topics mentioned in the curriculum and syllabus for BDS examination in the subject came into circulation. This book by the principal author Dr Tapasya Karemore and illustrious co-authors is the latest addition to the list.

The book is in two sections. All topics mentioned in the syllabus by the Dental Council of India are included in this textbook. The first section deals with the methods to learn oral diagnosis, clinical medicine, therapeutics and diagnostic tests. In the present century biotechnology has advanced very rapidly and, in most diseases, the final diagnosis is based on sophisticated molecular biological tests. Attempts made by the authors to include newer techniques in genomics and proteomics for diagnosis are applaudable.

The new cancer control programme (2017) of the Government of India includes screening of oral cancers at the primary health centre level. This programme has already been implemented in more than 100 districts. General medical practitioners and dental surgeons working in such programmes will find this book beneficial, as it contains several original, clinical photographs which would help them in diagnosing the same.

Newer areas of interest by the speciality like geriatrics, forensic medicine and physiotherapy in dentistry are added attractions.

Second section covers all the topics in oral radiology. The chapters on advanced imaging, soft tissue calcifications and ossifications as well as trauma teeth and jaws are novel and very useful.

In short, *Textbook of Oral Medicine and Radiology* principally authored by Dr Tapasya Karemore and the group of 31 brilliant specialists from India and abroad, is very comprehensive with all the topics as per the BDS syllabus and curriculum.

I wish the readers can take as much possible from this enriched resource.

07.07.2020

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Preface

Knowledge is power. Information is liberating. Education is the premise for progress..!
—Kofi Annan

Textbook of Oral Medicine and Radiology is a long cherished dream comes true for me as an author. I realize that it follows closely in the wake of several excellent textbooks in the subject. However, I sincerely felt that my knowledge, experience and wisdom gathered over the years of teaching and clinical practice can add value to what has already been written in this field.

I have tried to compile all concepts in the subject keeping in mind the needs of the undergraduate dental students towards learning the subject. One of the unique features of this textbook is the critical content validation from stalwarts having more than 20 years experience in the subject. Each chapter has undergone a comprehensive review procedure with strict adherence to the protocol till the final draft was found precise. Every topic covered has been kept abreast with updated knowledge and written in an 'easy to understand' format, along with special impetus to their clinical implications. Another exclusive feature is, those topics that could be combined, to discuss and correlate clinical and radiologic characteristics, have been included as a separate section. As per the changing paradigms in the subject, a few more novel topics such as 'Role of Oral Physiotherapy', 'Commonly Practiced Diagnostic Tests' and 'Drugs in Oral Medicine' have also been incorporated in the book. All the clinical pictures and radiographs included in the book are original and flowcharts and schematic diagrams have been used wherever deemed necessary. As the principal author of the book, I wish to offer this work to the budding dental health professionals of the society. It is my honest attempt to help the students to inculcate the knowledge in oral medicine and radiology and build confidence in diagnosis and management of various oral and maxillofacial conditions.

I sincerely hope students and professionals enjoy reading it and benefit from it.

Tapasya Karemore

Acknowledgments

It was a pleasure to complete this work along with all the authors, who have contributed wholeheartedly towards the completion of this book. I would like to acknowledge the contribution of all the authors, out of which some were my teachers, colleagues and my students. I, therefore, consider this as a unique opportunity to have three generations working for the project together and so the knowledge and experience over a long period of time could be compiled together. I am deeply indebted to the reviewers of this book Dr Mukta Motwani, Dr Shirish Degwekar, Dr Deepak Samdani, Dr Ramhari Sathwane and Dr Ranjitkumar Patil who gave critical inputs and helped me to improve myself as an author and to refine the scientific content. I thank my colleagues in the department Dr Apeksha, Dr Anurag, Dr Smriti and Dr Apurva for their timely help and cooperation. I am also indebted to my students and postgraduates Dr Manjiri, Dr Shruti, Dr Adeeba, Dr Shreya, Dr Rajni, Dr Trushita and Dr Rutuja for taking efforts in collecting clinical pictures of the patients. Dr Adeeba Siddiqui needs special mention for her contribution to the radiography section of the book.

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I thank Dr Babu Mathew for his precious words as Foreword for this book and Dr Rahul Bhowate for penning down his feelings in the About the Author section.

My gratitude to CBS Publishers & Distributors Pvt. Ltd., especially Mr. YN Arjuna, for meticulous designing and compilation of my work. I greatly appreciate their uncompromising attitude towards quality of the production.

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I heartily thank my parents, for believing in me and giving me the freedom to fulfill my dreams.

My beloved husband Dr Vaibhav has been by my side in all my endeavours as an integral part. Thanks in words cannot express my feelings for him. I am truly blessed.

It was heartening to see my sons Divit and Nivedit being always very supportive as such projects intrude a lot into family time. A big thanks to both of them.

Gratitude to the creator of this world 'God' for keeping me motivated enough throughout and blessed me with wonderful people around, to work harder!!

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I

Oral Medicine

Chapter 1

Case History, Diagnosis and Systemic Considerations

DEFINITION (AAOM)

Oral medicine is the specialty of dentistry that deals with the diagnosis and management of diseases that are non-surgical in nature, that may occur only in the oral cavity or may be an oral manifestation of systemic disease.

Oral cavity can reflect majority of systemic illness in children as well as adolescents. Oral health is integral factor of overall general health to which a clinician should be oriented while aiming at proper diagnosis and management.

Case history is defined as the data concerning an individual and his or her family and environment, including the individual's medical history that may be useful in analyzing and diagnosing his or her case or for instructional purposes. *(Grossman 13th Edition)*

History taking is an art, which a doctor learns over the years by repeated practice and experience. *(PJ Mehta)*

First interaction with the doctor can influence patient to answer every necessary leading question. It is advisable to consider patient's psyche as well, and not only the status of the disease.

IMPORTANCE OF HISTORY

- To aim at diagnosis
- To develop rapport with patient
- To know the psycho-social, economical, educational and health status of the patient so as to help in treatment planning.

Assessing patient's health, obtaining and evaluating history meticulously is mandatory for oral diagnostician. This method of history recording is divided into 4 major steps.

Steps:

1. Obtaining relevant information
2. Deriving provisional diagnosis
3. Carrying out necessary test to get final diagnosis
4. Formulating an accurate treatment plan.

Obtaining a patient's consent is another significant segment of case history taking.

A good case history should have the following information in a systematic manner.

a. **Demographic details:** This includes patient's name, age, sex, address, occupation, religion and marital status.
b. **Chief complaint:** This narrates about complaint with which patient has visited to doctor. These complaints should be recorded in chronological order along with duration.
c. **History of present illness:** This is related to complaints which patient had been dealing with, with all the symptoms right from initial days to present. Details of each symptom must be recorded separately. Associated symptoms must

be inquired and recorded. Similar illness in the past, duration and sequelae should be asked.

d. **Personal history:** It includes patient's appetite, diet, bowel and bladder habits, sleep cycle and associated habits of tobacco, kharra, betel nut, alcohol, snuff, khaini, smoking, etc.
e. **Family history:** The state of health of family members like, parents, grandparents, siblings should be noted. That history may include chronic and serious illness.
   - Few diseases run in family, so family history is of significance when a clinician deals with patient, e.g. X-linked recessive diseases—hemophilia, G6PD deficiency
   - Autosomal dominant disorders—neurofibromatosis familial hyperlipidemias
   - Autosomal recessive disorder—sickle cell anemia, beta thalassemia
f. **Menstrual and obstetric history:** Menstrual history is important to know, as it can be co-related with hormonal cycle and pregnancy.

GENERAL EXAMINATION

Includes following details:

In general examination we observe whether patient is conscious, cooperative and well-oriented with time, place and person, along with it we examine all vital parameters.

1. Built
2. Body proportions
3. Nutrition
4. Decubitus
5. Clubbing
6. Cyanosis
7. Jaundice
8. Pallor
9. Lymphadenopathy
10. Edema
11. Skin, hair and nails, vertebral column
12. Temperature
13. Pulse
14. Blood pressure
15. Respiratory rate

1. **Built:** It is the skeletal structure in relation to age and sex compared to a normal person. Conditions where altered built can be observed are:
   - *Tall:* Gigantism, hyperpituitarism, Marfan's syndrome
   - *Shrot:* Genetic, malnutrition, skeletal deformities, renal diseases.
2. **Body proportions**
   - *In adults:* Upper segment is equal to the lower segment
   - *In infants:* Upper segment is greater than the lower segment.
   - Due to genetic disorders this ratio can be altered, e.g. Marfan's syndrome, Klinefelter's syndrome
3. **Nutrition:** Proteins, fats, carbohydrates, vitamins and minerals are important for nourishment of human body. Deficiency of any of the nutritional factor should be observed and mentioned in the history, e.g. iron deficiency can cause pallor, koilonychia, calcium can cause tetany.
4. **Decubitus:** It is posture of the patient which he adapts when lying in bed, e.g.
   - *Hemiplegia:* One side of patient is immobile
   - *Tetanus:* The patient has neck stiffness.
   - *Pneumonia:* The patient is uncomfortable on lying on the affected side.
5. **Clubbing:** It is bulbous enlargement of soft parts of the terminal phalanges with both transverse and longitudinal curving of the nails. This occurs due to interstitial edema and dilation of the arterioles and capillaries.
   - Conditions leading to clubbing are: Tuberculosis, infective endocarditis, Crohn's disease, myxedema, etc.
   - *Schamroth's sign:* When two fingers are held together with nails touching each other, a diamond-shaped space is seen, which is lost in case of clubbing.

- Hypoxia is considered as possible cause for causing clubbing

6. **Cyanosis:** It is bluish discoloration due to reduced hemoglobin in capillary blood
   - Types of cyanosis are central, peripheral and mixed.
   - Causes of cyanosis can be, congestive cardiac failure, chronic obstructive lung disease, exposure to high altitude or cold, etc.
   - *Cause of cyanosis:* When the amount of reduced hemoglobin exceeds 5 gm% in the capillaries, the blood appears dark, giving the tissue a bluish hue.
7. **Jaundice:** It is a symptom complex which is characterized by yellow discoloration of tissue and body fluids due to increase in the bile pigments. Jaundice can be positive in intra-corpuscular defects, extra-corpuscular defects, disturbance in bilirubin transport and hepatocellular diseases. Normal serum bilirubin: 1 mg% (total)
8. **Pallor:** Pallor is paleness of skin and mucous membrane due to circulating red blood cells or diminished blood supply. Causes of pallor can be anemia, shock and peripheral vascular disease.
9. **Lymphadenopathy:** It is an inflammatory or non-inflammatory enlargement of lymph nodes.There are various causes of lymphadenopathy like inflammatory diseases, neoplastic diseases, and neurological diseases. It can be categorized as generalized or regional lymphadenopathy. For oral and maxillo-facial infections regional lymph nodes are commonly enlarged or show changes.
10. **Edema:** It is a collection of fluid in the interstitial spaces or serous cavities. It may occur due to increased capillary permeability like, in acute inflammation, increased capillary pressure, e.g. cardiac failure or decreased osmotic pressure of the blood in hypoproteinemia. So, various cardiac, renal, hepatic endocrinal and nutritional disorders are responsible for edema.
11. **Vertebral column, skin, hair, nails.**
    - **Vertebral column** has no lateral curvature. It should be examined for any abnormality, angular deformity, swelling or tenderness.
    - Patient can be asked to bend forwards, backwards, and sideways to evaluate changes in vertebral column, which maybe a result of scoliosis, kyphosis, gibbus, lordosis.
    - **Skin** can be examined for its color, pigmentation, eruptions, macule, vesicle, hemorrhage. Types of skin are dry, moist, thick, thin, and pinched.
      To deal with history of **hair**, various details can be obtained as, falling of hair (typhoid), patent hair loss, loss of eyebrows or excessive growth (Cushing's syndrome).
    - **Nails** should be examined for shape, size, pallor and relation to nail bed. Conditions that affect nails are: anemia, tuberculosis, cyanosis or clubbing due to systemic diseases, hemorrhagic condition.

Vital Parameters

12. **Temperature:** Fever is associated with release of endogenous pyrogens which activate T cell and shows active host defense. It refers to body temperature mechanism of the viscera and tissue of the body. It can be best recorded by mercury thermometer and is recorded in axilla as a chair-side method but can also be recoded by keeping thermometer orally or rectally(kids).
    Normal range of temperature; 36°–37°C or 98°–99°F. Fever is an increase of more than 1°C or any rise above normal temperature.
    Probable causes of fever can be infections, neoplasms, vascular diseases, trauma, immunologic diseses, endocrinal diseases, metabolic diseases, etc.
13. **Pulse:** The normal pulse with regular intervals has normal range of 60–100/minute.

Pulse can be *anacrotic pulse, dicrotic pulse, pulsus bisferiens, pulsus parvus of tardus, pulsus alternans, pulsus paradoxus, thread pulse, and water hammer pulse*.

14. **Blood pressure:** BP is measured in terms of systolic and diastolic. Systolic BP is controlled by stroke volume of heart and stiffness of the arterial vessels, whereas diastolic BP is controlled by peripheral resistance.
    Variation in BP can be due to emotional alteration, exercise, meals, alcohol, tobacco, bladder distension, pain or temperature rise. Also circadian rhythms, age and face can influence BP.
    Measuring BP can aid in diagnosis of hypertension, hypotension, pulsus paradoxus, pulsus alternans, and aortic incompetence.
15. **Respiratory rate (RR):** Normal rate of respiration is 16–20/minute.
    - Increased RR (tachypnea) is evident in a few conditions like, exertion and excitement, fever, anorexia, and anemias while decreased RR (bradypnea) can be seen in poisoning like narcotic drugs and brain tumor.
    - Dyspnea is breathlessness, which can be seen with congestive cardiac failure, asthma, pneumonia, COPD.

BODY SYSTEMS: EVALUATION FOR SYMPTOMS (PAST MEDICAL HISTORY)

Obtaining accurate past medical history (PMH) is also important in history taking as it helps to identify oral manifestation of systemic disorders, in diagnosing and treating the condition and sometimes in handling relevant medico-legal issues.

- **Respiratory system:** Chest pain, wheezing, dyspnea, cough, hemoptysis.
- **CVS:** Chest pain, dyspnea, edema, claudication
- **GIT:** Appetite, dysphagia, nausea, vomiting, hematemesis, indigestion, pain, diarrhea, constipation, bloating, jaundice.
- **Genito-urinary:** Urinary frequency, dysuria, hematuria, nocturia, incontinence, discharge.
- **Endocrine:** Polyuria, polydypsia, pigmentation, temperature intolerance.
- **Hematologic:** Spontaneous gingival bleeding, long bleeding time, easy bruising, epistaxis.
- **Dermatologic:** Pruritus, rashes, pigmentation, eruptions, allergy.
- **Musculoskeletal (spasm of muscles of TMJ and accessory muscles of mastication):** Changes in range of motion of joint, joint swellings, joint deformities, pain of muscles or joint, joint sounds.
- **Lymphatic system:** Enlarged nodes, mobility.
- **ENT:** Oropharynx, nasopharynx, voice changes.

EXTRAORAL EXAMINATION

It includes examination of head, facial symmetry, TMJ, lymph nodes, ears, nose, eyes.

Examination is carried out in a dental chair with the head completely rested or supported. This aids in accurate extraoral examination of the patient.

This examination in dental office is restricted to the superficial tissues of the oral cavity, head and neck.

- **Facial symmetry:** This can guide towards uniformity of facial structures, bilaterally. It can be examined under two headings—symmetrical or asymmetrical.
  Face can be asymmetrical due to swelling, genetic disorder, trauma, etc.
- **TMJ:** Joint is examined for range of motion, swelling, pain of muscles, joint, palpation of muscles and joint or any other obvious abnormality (detail examination of TMJ is covered in chapter on TMJ diseases)
- **Ear, nose:** Examined for observable pathology, bleeding and pain.
- **Lips:** Lips are examined for presence of lip seal. Swelling, painful ulcer, gingival enlargement, etc. can alter competency of lips.

- **Eye:** Eyes are examined for intercanthus and eyeball distance, vision or other developmental abnormalities.
- **Neck (lymph nodes):** Regional lymph nodes are cervical group of lymph nodes (submental, submandibular, parotid, post-auricular, pre-auricular, occipital, and others are superficial, deep and anterior cervical nodes).

Nodes are examined under the headings of group of lymph nodes, mobility, side enlargement, dimension, tenderness, number, discharge, fixity to underlying structure, consistency and overlying skin.

Lymph node examination: For submandibular LN clinician stands behind the patient. With fixed neck, clinician uses tip of the first two fingers placing them medial to the body of mandible to palpate the nodes.

Cervical group of LN can be palpated anteriorly and posterior to the sternocleidomastoid (SCM) muscle. (By rotation of neck to opposite side, SCM becomes prominent which facilitates LN examination). There are many clinical conditions causing lymphadenopathy like local or systemic. Most common causes include infections of odontogenic origin, tuberculosis, malignancy, lymphomas or other non-specific lymphadenopathy, etc.

In acutely inflamed ulcers, the regional lymph nodes become enlarged, tender and show signs of acute lymphadenitis. Later on the nodules become soften to form an abscess.

In malignant ulcers, the nodes are stony hard and may be fixed to the neighboring structures in the later stages.

INTRAORAL EXAMINATION

Hard tissue and soft tissue examinations are covered in this section of history.

Hard tissue involves teeth while soft tissue includes all mucosae, tongue, gingiva, oropharynx, faucial pillars, uvula hard palate.

- **Lips:** Normal is pink, smooth and moist. It shows minor salivary glands.
- **Cheeks:** Moist and pink, Fordyce's granules, salivary gland opening (parotid)
- **Floor of mouth:** Lingual frenum, sublingual fold, sublingual carbuncle.
- **Tongue**
  - *Dorsum:* Papilla present and median furrow.
  - *Ventral surface:* Lingual frenum attached and varicosities
  - *Movements*
  - *Lateral borders*
- **Palate (soft/hard):** Minor salivary glands and their opening.
- **Gingiva**
  - Coral pink in color.
  - Firm and resilient in consistency.
  - Stippling present with orange peel appearance.
- **Orifice of salivary ducts**
  1. Parotid gland: Parotid duct
     - The duct opens into the mouth on the inner surface of cheek usually opposite to the maxillary 2nd molar.
  2. Submandibular gland: Wharton's duct
     - It opens by narrow opening on the summit of a small papilla at the side of frenum on the tongue.
  3. Sublingual gland: Bartholins's duct
     - The sublingual glands are drained by 8–20 excretory ducts known as duct of Rivinus.
     - Most of the remaining small sublingual ducts open into the floor of the mouth.
- Tonsillar pillar
- **Hard tissue:** Teeth

  Hypoplasia
  - Enamel hypoplasia
  - Dentin dysplasia
  - Fluorosis
- **Caries:** Initial/moderate/deep/pulp involvement
- Missing
- Filled
- Endodontically treated

- **Mobile**
  - Periodontitis
  - Pulpal infection
  - Trauma
  - Malignancy
  - Trauma from occlusion (TFO)
- Wasting disease
- **Over retained**
  - Ankylosis of tooth
  - Incomplete resorption of primary tooth
- **Supernumerary teeth**
  - Cleidocranial dysplasia
  - Familial adenomatous polyposis
  - Trichorhinophalangeal syndrome,
  - Type I: Rubinstein-Taybi syndrome
  - Nance-Horan syndrome
  - Opitz BBB/G syndrome
  - Oculofaciocardiodental syndrome
  - Autosomal dominant Robinow syndrome.
- Malposed
- Malformed
- Root stumps
- **Discolored/non-vital**
  - Trauma, physical/chemical injuries, caries, etc.
- **Fractured**
  - Trauma, malocclusion, dysplastic teeth, abrasion, erosion, etc.
- **Impacted**
  - Various syndromes are associated with impacted teeth which are either pathogenic or genetic (cleidocranial dysplasia, Gardner's syndrome, Down syndrome, etc.)
- **Migration**
  - Pulpal or periodontal infections
  - Pathogenic cause like cyst, tumors, etc.
- Removable partial denture
- **Edentulous jaw:** Roots pieces, bone spicules, tori, etc.
- **Deposits:** Stains
  - Calculus
  - Plaque
- Periodontal status

TABLE 1.1: Causes of stains

Extrinsic	*Intrinsic*
Remnant of Nasmyth membrane Poor oral hygiene Existing restoration Gingival bleeding Plaque and calculus Eating habits: Tea, coffee, stains, etc. Tobacco chewing habit Chromogenic bacteria Mouthwashes: Chlorohexidine	Hereditary disorders Medication Excess fluoride High fever associated with early childhood illness and other types of trauma. Stains located inside enamel and dentin.

Gingiva Examination

- Color, contour
- Consistency
- Bleeding on probing

TABLE 1.2: Clinical signs of pulpitis, periodontitis and gingivitis

Signs of pulpitis	*Signs of periodontitis*	*Signs of gingivitis*
No sensation to cold and hot temperature Sharp shooting, piercing and lancinating pain (due to involvement of delta nerve fibres) or dull, boring, gnawing and excruciating (C-fibres). Often localized to apex, with a fistulous tract. Mobility of the tooth may or may not be present. Often severe and difficult to localize. Tooth may have large restoration. Problem related to apex.	Tooth sensitive to hot or cold stimuli. Presence of periodontal pocket. Presence of bleeding on probing. Presence of recession Mobility Malodour Teeth migration Dull aching pain on mastication	Tooth sensitive to hot or cold stimuli. Presence of gingival pocket. Presence of bleeding on probing Reddish discoloration and swelling in the marginal gingival. Increase in gingival crevicular fluid.

- Enlargement
- Recession
- Surface texture
- Interdental papillae
- Irritation from prosthesis or overhanging restoration.

Examination of Swelling (Extraoral)

Inspection

- Site, number
- Extent
- Shape
- Surface texture
- Color
- Edge
- Pulsation
- Overlying skin
- Surrounding tissue
- Limitation of movement
- Sinus/fistula discharge

Palpation

All inspectory findings are confirmed by palpation

- Temperature
- Tenderness
- Consistency
- Fixity to underlying structure
- Translucency
- Compressibility
- Pulsatile
- Fixity to overlying structures
- Blanching effect

Examination of Swelling (Intraoral)

Intraoral Inspection

- Site
- Number
- Size
- Shape
- Surface texture
- Color
- Edge
- Number
- Pulsation
- Limitation of movement
- Surrounding tissue

Palpation

All the inspectory findings are confirmed on palpation.

- Temperature
- Tenderness
- Consistency
- Fixity to underlying structures
- Translucency
- Compressible
- Pulsatile
- Fixing to underlying tissue

ULCER EXAMINATION

Inspection

- Size, shape and color
- Number
- Site
- Edge (raised/sloping/punched out/undermined/rolled out/everted.)
- Floor
- Discharge
- Surrounding area

Palpation

- Tenderness
- Edge
- Base
- Depth
- Bleeding
- Relation to deeper structures
- Surrounding area

Intraoral Inspection

- Size and shape
- Number
- Position
- Edge

Provisional diagnosis: After detailed history taking and critical clinical examination, the signs and symptoms collected can guide to arrive at a diagnosis which is known as provisional diagnosis.

Differential diagnosis: Similar disorders, or diseases with overlapping features are rearranged as a list with most probable lesion

ranked at the top and least probable at the bottom.

Chair Side Clinical Investigation

Vitality Test

- Thermal tests
- Electric pulp testing (EPT)
- Bite test
- Anesthesia testing
- Test cavity
- Laser-Doppler flowmetry
- Pulse oximetry
- Dual wavelength spectrophotometry
- **Thermal:** Heat, cold, electric pulp testing
- Aspiration

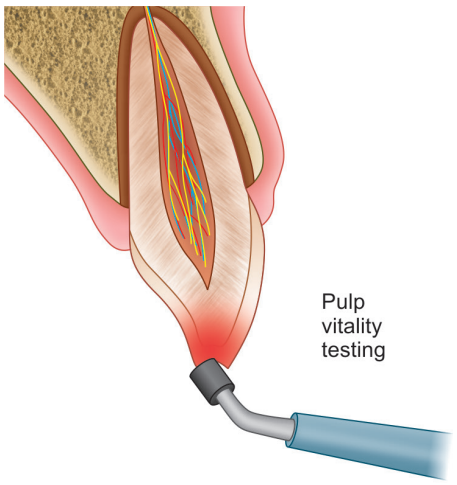

Fig. 1.1: Electronic pulp test

Fig. 1.2: The brand Vital Ice for cold test

Radiographic Investigations

This includes conventional (intraoral and extraoral) and advanced imaging modalities used to arrive at final diagnosis.

Conventional radiographic investigations: PA view or any other advanced imaging investigations include CT, MRI, VSG, scintigraphy, PET scan.

Laboratory investigations like routine hemogram, ESR, calcium, blood sugar, etc. are suggested related to the case to be diagnosed.

Special Investigations

1. **Blood test**
   - To detect any systemic disorder.
   - Total and differential count of WBC, hemoglobin, RBC count, ESR should be done.
2. **Examination of urine**
   - Particularly sugar estimation, to exclude diabetes, is important.
3. **Bacteriological examination of the discharge**
   - It is particularly important in inflamed and spreading ulcers.
   - This will not only give a clue as to the type of organism present in the ulcer, but also its sensitivity to a particular antibiotic.
4. **Biopsy**
   - Very important in malignant ulcers.
   - Biopsy is generally taken from edge of the ulcer, taking apportion of surrounding health tissue.
   - Biopsy material is then examined histologically to know the type of tumor, its invasiveness and whether differentiated or anaplastic.

Other tests include, scrape cytology, staining techniques and culture sensitivity tests.

- Final diagnosis
- Treatment plan
- Drugs/prescription
- Prognosis

Examination of Ulcer

An ulcer is a break in the continuity of the covering epithelium, skin or mucous membrane. It may either follow molecular death of the surface epithelium or its traumatic removal.

History

1. Mode of onset
2. Duration
3. Pain
4. Discharge
5. Associated disease

Local Examination

1. **On inspection**
   - i. *Size and Shape*
     - *Oval:* Generally seen in tuberculous ulcers.
     - *Circular:* Seen in syphilitic ulcers.
     - *Irregular:* Seen in carcinomatous.
   - ii. *Number*
     - *Multiple ulcers:* Herpetic ulcers
     - *Usually single:* Syphilitic and tuberculous ulcer
   - iii. *Floor:* This is the exposed surface of the ulcer.
     - *Red granulation tissue:* Healing ulcer.
     - *Pale and smooth granulation tissue:* Slow healing ulcer.
     - *Watery granulation tissue:* Tubercular ulcer.
   - iv. *Edge:* 5 common types of edges:
     - a. Undermined edge is most commonly seen in tuberculous ulcer.
       - The overhanged skin is thin, friable, reddish blue and unhealthy.
     - b. Punched out edge is most commonly seen in a gummatous ulcer or in a deep trophic ulcer.
       - The edge drops down at right angle to the skin surface as if it has been cut out with a punch.
     - c. Sloping edge is mostly seen in healing traumatic or venous ulcers.
       - Every healing ulcer has a sloping edge, which is reddish purple in color and consists of new healthy epithelium.
     - d. Raised and pearly-white beaded edge is a feature of rodent ulcer.
       - This type of edge develops in invasive cellular disease and becomes necrotic at the centre.
     - e. Rolled out (everted) edge is a characteristic feature of squamous cell carcinoma.
   - v. *Discharge:* The character of discharge and its amount should be noted.
     - *Scanty serous discharge:* Healing ulcer
     - *Purulent discharge:* Spreading inflamed ulcer
     - *Blood:* Malignancy.
   - vi. *Surrounding area*
     - If the surrounding area of an ulcer is glossy, red and edematous, the ulcer is acutely inflamed.
     - All the findings of inspection are confirmed on palpation.
       - a. *Tenderness*
         - *Exquisitely tender:* Acute inflamed ulcer
         - *Slightly tender:* Chronic ulcers like tuberculous
         - *Never tender:* Neoplastic
       - b. *Edge and margin*
         - *Edge* is the area between the margin and the floor of the ulcer.
         - *Margin* is the junction between normal epithelium and ulcer, so it is the boundary of the ulcer.
       - c. *Base:* It is on which the ulcer rests.
         - If an attempt is made to pick up the ulcer between the thumb and the index finger, the base will be felt.
         - *Slight indurations*: Chronic ulcer.
         - *Marked indurations*: Squamous cell.
       - d. *Depth*
         - It can be recorded in mm.

- Trophic ulcers may be as deep to reach even the bone.

e. *Bleeding*
- Whether the ulcer bleeds to touch or not?
- Commonly seen in malignant ulcer.

f. *Relation with deeper structures.*
- The ulcer is made to move over the deeper structures to know whether it is fixed to any of these structures.
- Malignant ulcer is fixed to the deeper structure by infiltration.

g. *Surrounding skin*
- Increased temperature and tenderness of the surrounding skin indicates the ulcer to be of acute inflammatory origin.
- Fixity to deeper structures indicates the malignant nature of the lesion.

vii. *Position*

EXAMINATION OF SWELLING

Definition

1. Swelling is an abnormal enlargement of a part of body, typically as a result of an accumulation of fluid
2. Swelling is a vague term which denotes any enlargement or protuberance in the body due to any cause.

1. Inspection

a. Site
- Exterior angular dermoid: Lateral end of eyebrow
- Meningocele: Back in midline

b. Size (in cm)
c. Shape
d. Surface
- Smooth: Sebaceous cyst
- Modular: Multinodular goiter

e. Skin
- Pigmentation / ulceration / discharge

f. Surrounding area
- Pigmentation / edema / discoloration

g. Others
- Number
- Color
- Edges
- Extent
- Visible parameters

2. Palpation

a. Temperature
- Increase in inflammation

b. Tenderness
- Swelling related to nerves

c. Inspectory findings
- Size, shape, surface
- Edge and extent
- Depth

d. Consistency
e. Fluctuations
- Fluid or gas
- Hydrocele

TABLE 1.3: Types of swellings

Congenital	*Inflammatory*	*Traumatic*	*Neoplastic*	*Miscellaneous*
▪ Dermoid cyst ▪ Hemangioma	▪ Abscess (pyogenic, pyemic, cold abscess) ▪ Boil ▪ Carbuncle ▪ Erysipelas ▪ Cellulitis	▪ Implantation dermoid	▪ Fibroma ▪ Lipoma ▪ Lymphangioma ▪ Neurofibroma ▪ Malignant (basal cell carcinoma, squamous cell carcinoma, malignant melanoma, sarcoma)	▪ Sebaceous cyst ▪ Warts ▪ Condyloma ▪ Keloid/hyper-trophic scar ▪ Keratoacanthoma ▪ Callosity/corn

f. Translucency (transmission of light through swelling)
- Positive: Clear fluid and their transparent walls.
- Negative: Wall thick, turbid liquid (blood or pus or lymph)

g. Reducibility: Can disappear completely and reappears by straining or coughing.
- Hernia
- Varicocele

h. Compressibility (swelling on pressure reduces in size, but only partially. It does not disappear completely).
- Hemangiomas

i. Pulsatility

j. Fixity to skin
- Fixed to skin cannot be lifted.
- Skin moves over swelling.

3. Percussion

Not needed

4. Auscultation

Look for any bruit over pulsating swelling.

a. **Color**
- Arterial haemangioma: Bright red
- Venous haemangioma: Purple
- Malignant melanoma: Black
- Benign naevus: Black
- Ranula: Bluish

b. **Skin overlying swelling**
- Red and edematous: Inflammatory
- Black punctum: Sebaceous cyst
- Pigmentation: Moles, naevi
- Scar
- Ulcers

c. **Surface**
- Smooth: Cystic swelling
- Lobular: Lipoma
- Nodular: Multinodular
- Matted: Lymph nodes
- Irregular: Carcinoma

d. **Edge**
- Well-defined and irregular: Benign neoplasm
- Well-defined and irregular: Neoplasm
- Ill-defined and diffuse: Inflammatory swelling

e. **Consistency**
- Soft: Lipoma
- Cystic: Chronic abscess
- Firm: Fibroma
- Bony hard: Osteoma
- Variable consistency: Malignancy

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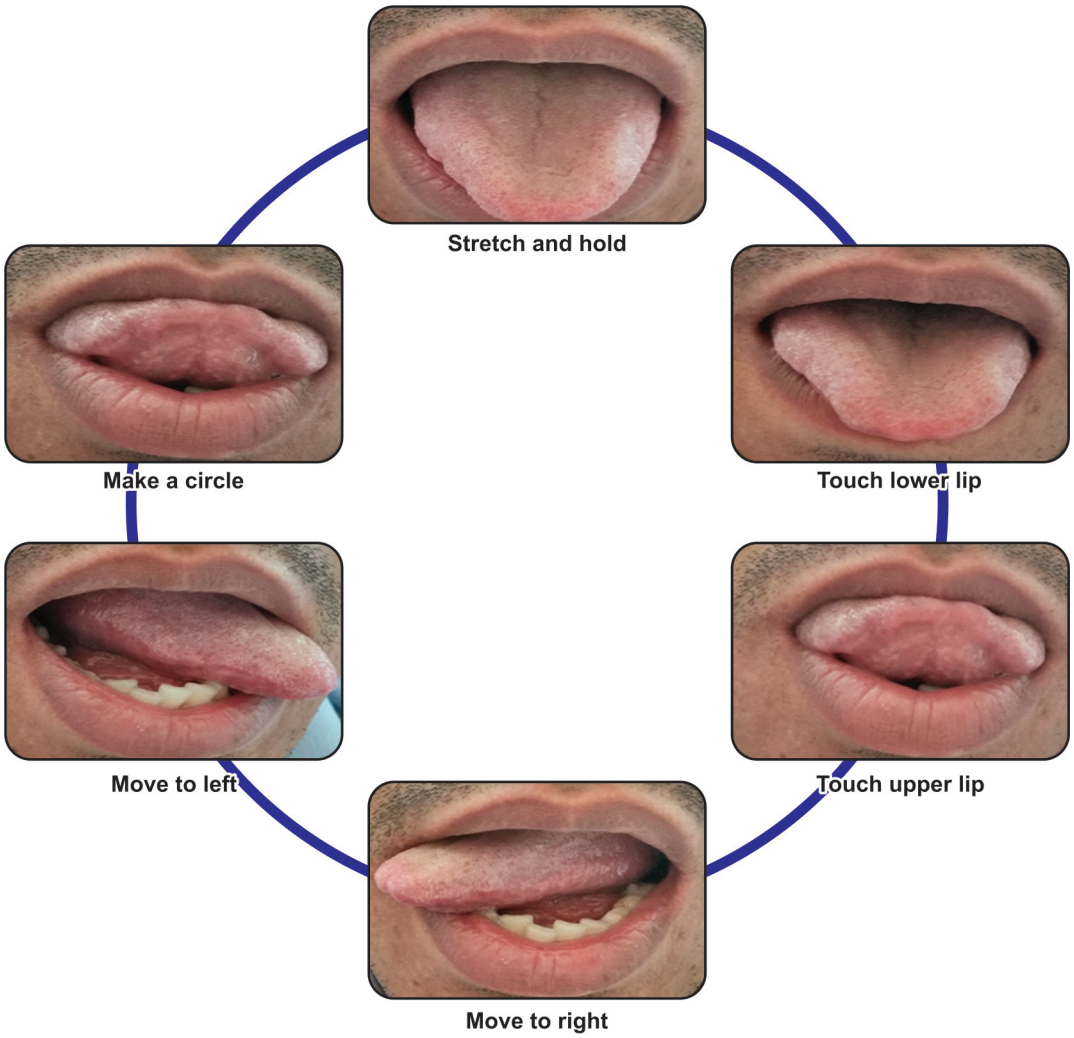


Fig. 4.2: Tongue exercises

joint disorder, acute lock, trauma-induced joint pain, chronic closed lock, capsulitis, hypermobility, hypomobility and oral submucous fibrosis.

ELECTROTHERAPY

Electrotherapy creates an electric field to stimulate or alter healing process, resulting in pain relief and tissue regeneration.

- **Transcutaneous electrical nerve stimulation:** It utilizes a high frequency (50–100 Hz), but very low intensity electric current which stimulates the nociceptive A-beta cutaneous afferents that activate the descending pain-inhibitory mechanism. It is perceived as a tingling or vibratory sensation with phasic muscle/no phasic muscle contraction. It is useful in acute pain, chronic intractable pain, trigeminal neuralgia, peripheral nerve injuries, myofascial pain dysfunction syndrome, post-TMJ surgery and causalgia.

Contraindications listed by manufacturers include pregnancy, infection, malignancy, and pacemaker.

TABLE 5.1: Types of HHV

Type of human herpesvirus (HHV)	*Primary infection*	*Recrudescent lesions in healthy hosts*	*Recrudescent lesions in Immunocompromised hosts*
Herpes simplex virus 1 (HHV-1)	Gingivostomatitis, kerato-conjunctivitis, genital and skin lesions	Herpes labialis ("cold sores" "fever blisters"), intraoral ulcers, kerato-conjunctivitis, genital and skin lesions	Ulcers at any mucocutaneous site, usually large and persistent; disseminated infection
Herpes simplex virus 2 (HHV-2)	Genital and skin lesions, gingivostomatitis, kerato-conjunctivitis, neonatal infections, aseptic meningitis	Genital and skin lesions, gingivosto-matitis, aseptic meningitis	Ulcers at any mucocutaneous site, usually large and persistent; disseminated infection
Varicella-zoster virus (HHV-3)	Varicella (chickenpox)	Zoster (shingles)	Disseminated infection
Cytomegalovirus (HHV-4)	Infectious mononucleosis, hepatitis, congenital disease		Retinitis, gastroenteritis hepatitis, severe oral ulcers
Epstein-Barr virus (HHV-5)	Infectious mononucleosis like hepatitis, encephalitis		Hairy leukoplakia, lympho-proliferative disorders, mucocutaneous ulcers
HHV-6	Roseola infantum (affects children below 3 years), exanthema subitum, otitis media, encephalitis		Fever, bone marrow suppression
HHV-7	Roseola infantum		
HHV-8	Infectious mononucleosis like febrile exanthema		Kaposi sarcoma, lympho-proliferative disorders, bone marrow suppression

affecting any part of the oral mucosa, rupture to form painful, **s**mooth, **r**ound, **s**hallow, **s**ymmetrical and small ulcers with surrounding tissue tags (***moon crater appearance***). The ulcers heal without scarring in 1 to 2 weeks. There is erythematous involvement of marginal gingiva which is characteristic of herpes infection. It may be associated with pharyngitis and there is cervical lymphadenopathy.

Fig. 5.5: Intraoral herpes infection

2. **Secondary or recurrent herpes simplex infection**

Predisposing factors cause reactivation of virus and the patient experiences prodromal symptoms of tingling, burning or pain at the site. Clusters of vesicles form, which often go unreported by the patient, since they soon rupture and coalesce to form large ulcers. Vesicular lesions mostly occur only on the lips and are referred as recurrent herpes labialis (RHL). Sometimes ***clusters of***

Fig. 7.11: IOPA and occlusal radiograph show irregular radiopacity in upper anterior region

more common in coronoid process, condylar head and neck and symphysis, where cartilaginous tissue is more.

The lesion is slow growing, round, ovoid or lobulated with well-defined corticated borders. Aggressive lesions have infiltrative ill-defined margins. Some form of calcification within the center is seen giving them a mixed radiolucent-radiopaque appearance. Typically described as ***moth-eaten appearance***. The central radiopaque structure has been described as ***flocculent or snow-like*** features.

Since they are slow growing tumors, hence there is expansion of cortical boundaries rather than destruction. Displacement and mobility of teeth is present. In mandible the inferior border is grossly expanded. Maxillary lesions may push the walls of maxillary sinus or nasal fossa and impinge on the infratemporal fossa. Peripheral new bone formation may resemble ***sun ray or hair on end*** appearance. When condyle is involved, there may be widening of temporomandibular joint space with its remodeling.

Differential Diagnosis

Osteosarcoma: It is relatively more aggressive and has more infiltrative margins.

Fibrous dysplasia: It occurs in younger age with characteristic radiographic appearances.

RADIOGRAPHIC FEATURES OF EWING'S SARCOMA

It mostly affects the long bones and rarely affects the jaw. It is highly invasive tumor with high metastatic potential.

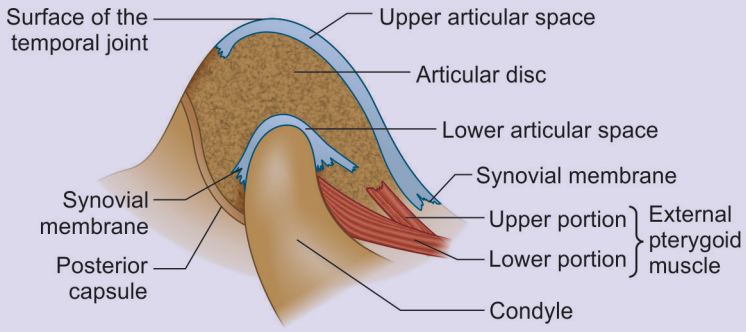
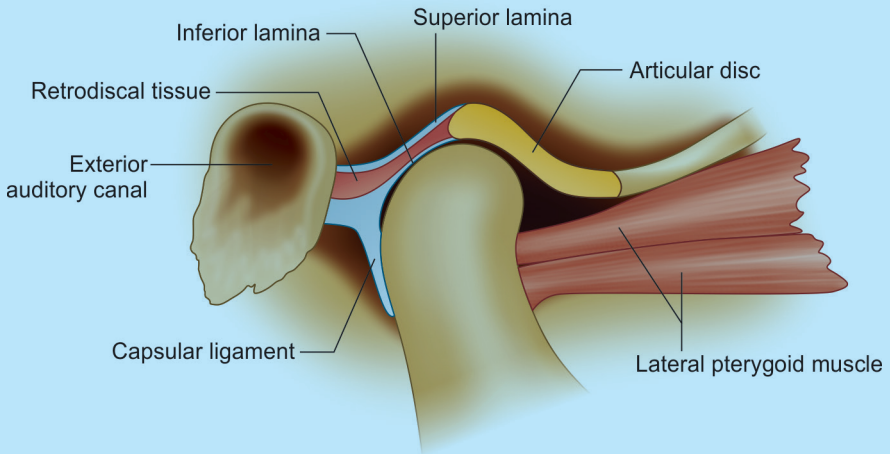
It is more common in mandibular posterior areas and mostly affects in second decade of life. It is common in males.

The borders of the lesion are poorly demarcated and never corticated. Its advancing edge destroys bone in an uneven fashion resulting in ragged borders. The internal structure is entirely radiolucent.

It stimulates the periosteum to produce new bone causing laminar periosteal new bone formation which is described as ***onion skin appearance. Codman's triangle or hair on end appearance*** may also be seen.

It does not cause root resorption but destroys the supporting bone of adjacent teeth causing mobility. Cortical borders of maxillary sinus, inferior alveolar canal and lower border of mandible may be effaced. There is destruction of dental follicle and lamina dura of adjacent teeth.

TABLE 11.1: Anatomy of TMJ *(Contd.)*

Articular disc	▪ A fibrocartilage is made up of dense collagen and referred to as a disc which occupies the space between the fibrocartilage coverings of each of condyle and mandibular fossa. ▪ The disc consists of collagen fibers, cartilage like proteoglycans, and elastic fibers and number of cells that resemble fibrocytes and fibrochondrocytes. ▪ The disc is primarily avascular and has sensory nerve penetration. It is attached by ligaments to the lateral and medial poles of the condyle. The ligaments consist of both collagen and elastic fibers. These ligaments permit rotational movement of the disc on the condyle during mouth opening and closing. ▪ The disc and its attachments divide the joint into upper and lower compartments which do not communicate. The passive volume of the upper compartment is estimated to be 1.2 ml and that of the lower compartment is estimated to be 0.9 ml. The roof of the superior compartment is the mandibular fossa, and floor is the superior surface of the disc. The roof of the inferior compartment is the inferior surface of the disc and the floor is the articulating surface of the mandibular condyle. At its margins, the disc blends with the fibrous capsule. ▪ Fibers of the posterior one-third of the temporalis muscle and the deep masseter muscle attach on the anterolateral aspect, and fibers of the superior head of the lateral pterygoid insert into the anteromedial two-thirds of the disc.  **Fig. 11.1**
Retrodiscal tissue	 **Fig. 11.2**

Contd.

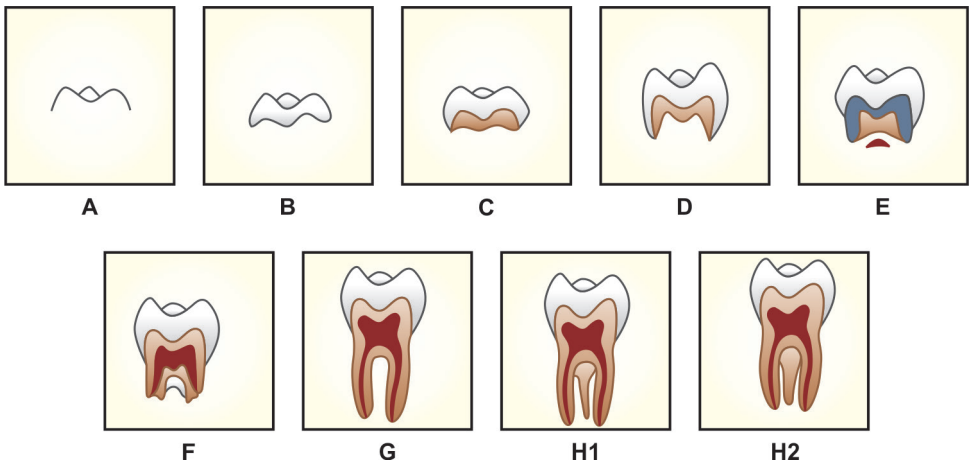


Fig. 23.3: Demirjian's method

to this law the third molar in spite of having an erratic calcification and eruption timing is still considered vital since it is the only tooth undergoing calcification.

Eruption Timing

Eruption is regarded the least accepted method for dental age assessment. This is because eruption of teeth is known to be affected by dietary, climatic, racial and geographical variation. The deciduous teeth help estimate age from 6 to 33 months and permanent teeth help estimate age from 6 to 25 years. The advantage of this method is that it does not require any special equipment, expertise and is very economical.

Age Estimation in Adults

Gustafson's method: Gustafson evaluated ground sections of teeth for 6 parameters. These 6 physiological parameters which included attrition, loss of periodontal attachment, secondary dentin deposition, sclerotic or transparent dentin formation, root resorption and cemental apposition were measured and given a score from 0 to 3. The above parameters were chosen since they showed age related changes. Transparent or sclerotic dentin and secondary dentin formation have the most correlation with age, and the former can be used independently to estimate age as well. The drawback of this method is that it is subjective. Johanson modified it and introduced 6 scores instead of 3 with an interval of 0.5. This decreased the subjectivity of the method.

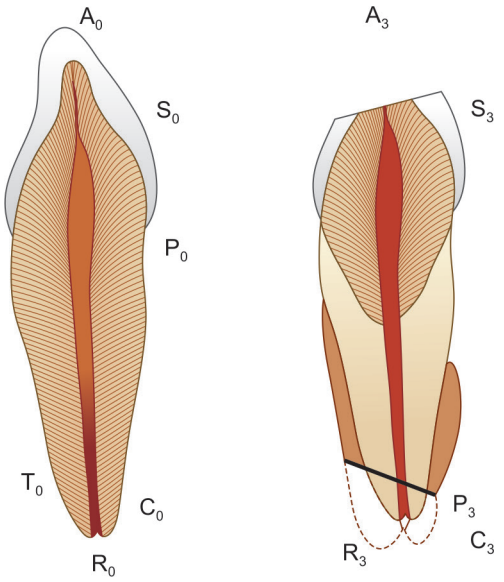


Fig. 23.4: Gustafson's variable and the first and last grades given by Johanson

Bang and Ramm's method: Transparent dentin or sclerotic dentin measurement is a relatively accurate and easy method to estimate age. Root dentin becomes transparent during the third decade of

Fig. 24.5: Generalized alveolar bone loss

- Cellular atrophy
- Sclerosis

With aging, changes in bone composition have also been observed that alter the volumetric proportions of adipose tissue, hematopoietic tissue, trabecular bone and osteoid, the unmineralized newly formed matrix, decreases by 3 fold by age 20, then remains constant.

The volume of hematopoietic tissue is also highest in the young, decreasing by 50 to 60% by age 40. Adipose tissue volume increases throughout life, with the most marked increase occurring between the ages of 40 and 60 years. Bone volume declines by 30% or more after age 60.

Osteopenia is a condition of low bone mass and osteoporosis is a disease in which low bone mass is associated with fractures. Both the conditions are common in old age but difficult to diagnoses. Osteoporosis is regarded as being more frequent and advanced in elderly females than elderly males.

Changes in Oral Mucosa with Aging

As a result of the metabolic changes in the elderly person, including a shift in water balance the oral mucous membranes may become atrophic and friable taking on a shiny wax-like appearance.

The gingivae also show these changes together with a loss of stippling.

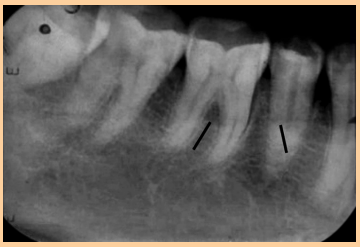
The progressive thinning of the epithelial layer occurs in combination with a decrease in the elastic properties of connective tissue. Clinically these effects add up to a reduction in resiliency of those tissues which may be subjected to pressure.

In addition, the decrease in surface capillaries and consequent reduced blood supply delay micronutrition and impairs the capacity to regenerate.

As a result of the above disturbances, the aging mucosa is more sensitive to external influence. It can be easily damaged by coarse food or ill-fitting appliances and its healing capacity is markedly slower than mature mucosa.

Fig. 24.6: Coatings on tongue mucosa

TABLE 29.2: Errors in film processing (*Contd.*)

Error—patient preparation	*Causes*	*Radiographic image*
8. Magnification	• Decreased focal spot to object distance • Increased object to film distance	
9. Tire track appearance	• Back side of the film with the lead foil placed facing towards the cone	
10. Black lines on the radiograph (bending marks)	• Excessive bending of the film (to reduce patient discomfort)	
11. Dark radiographs	a. Prolonged exposure time b. Increased mA c. Increased kVp d. Decreased source to film distance	
12. Light radiographs	a. Reduced exposure time b. Decreased mA c. Decreased kVp d. Increased source to film distance	

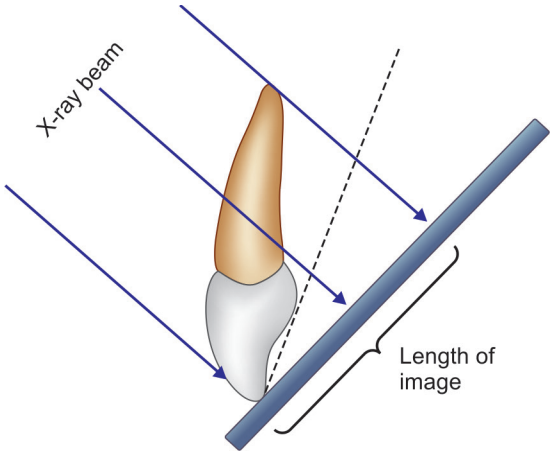


Fig. 31.10: Central ray perpendicular to the long axis of the film causing foreshortening of the resultant image

Fig. 31.11: IOPA radiograph in bisecting angle technique

- *Maxillary third molars:* Point of intersection of ala-tragus line and perpendicular line from distal to the outer canthus of the eye.
- *Mandibular central incisors and lateral incisors:* Tip of the chin.
- *Maxillary canines:* Point of intersection of 0.5 mm above the lower border of the mandible to a perpendicular line from the pupil of the eye.
- *Maxillary premolars:* Point of intersection of 0.5 mm above the lower border of the mandible to perpendicular line from distal to the outer canthus of the eye.

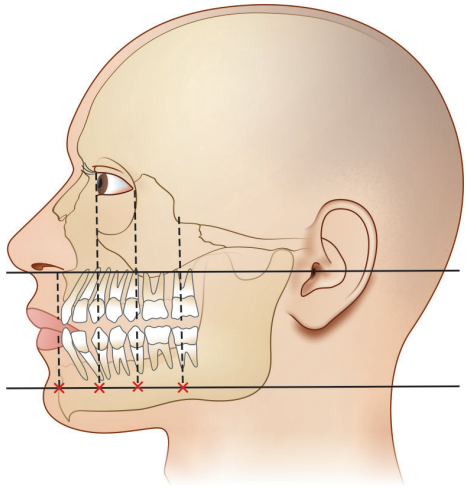


Fig. 31.13: Point of entry for mandibular teeth projection

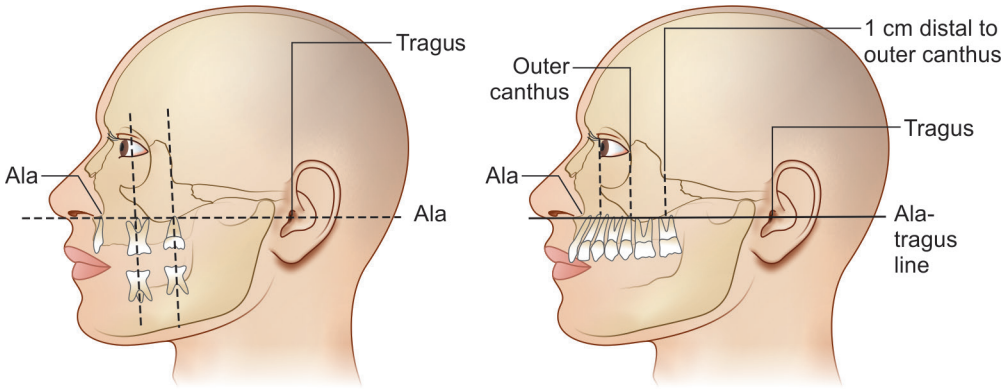


Fig. 31.12: Point of entry for maxillary teeth projection

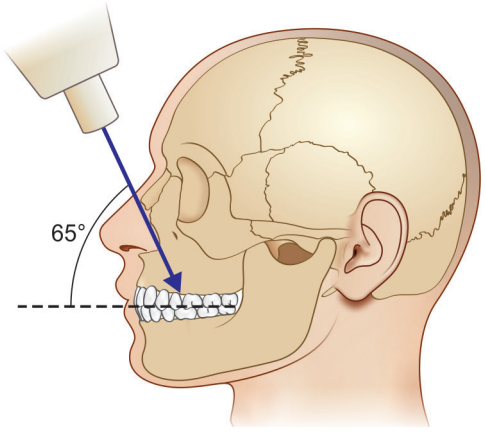


Fig. 31.21: Cross-sectional occlusal projection view

Fig. 31.22: Cross-sectional occlusal radiograph

- *Film positioning:* Film should be stabilized by gently closing the mouth and biting the film.
- *PID angulation:* +65° vertical angulation and 0° horizontal angulation
- *Point of entry:* Central ray should pass though the bridge of the nose.
- *Exposure:* Exposed towards the middle of the X-ray film.

Lateral occlusal projection view (Figs 31.23 and 31.24)

- *Patient position:* Midsagittal plane should be perpendicular to the floor and occlusal plane should be parallel to the floor.
- *Film placement:* Film should be placed with the white surface of the film towards the maxilla and lateral border of the film should be parallel with the buccal surface of the posterior teeth with extending 1 cm past the buccal cusp.
- *Film positioning:* Film should be stabilized by gently closing the mouth and biting the film.
- *PID angulation:* +60° vertical angulation and 0° horizontal angulation
- *Point of entry:* Central ray should pass approximately 2 cm below the lateral canthus of the eye directed towards the center of the film.

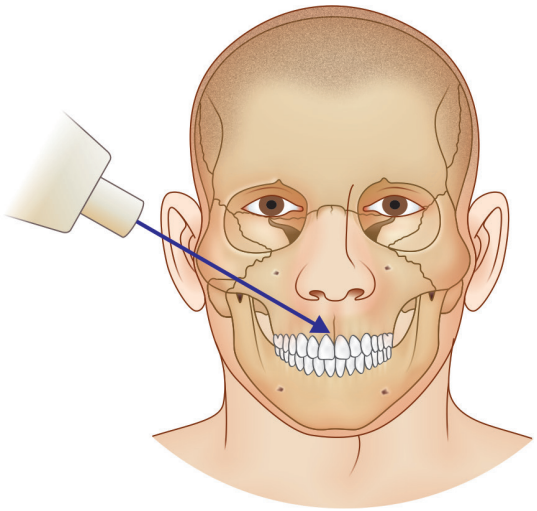


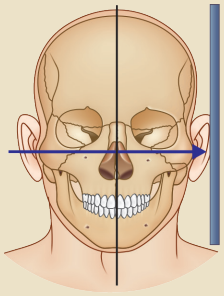
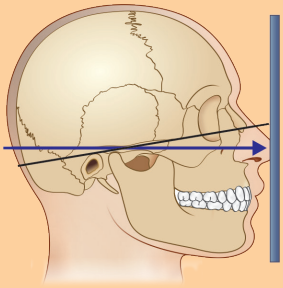
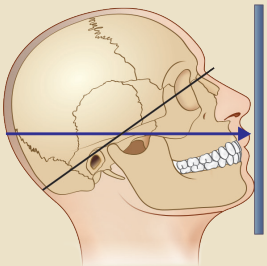
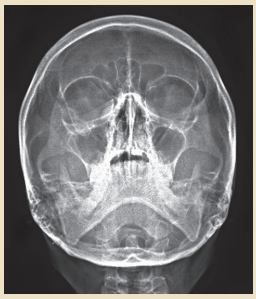
Fig. 31.23: Lateral occlusal projection view

Fig. 31.24: Lateral occlusal radiograph

TABLE 34.5: Reverse Towne's projection

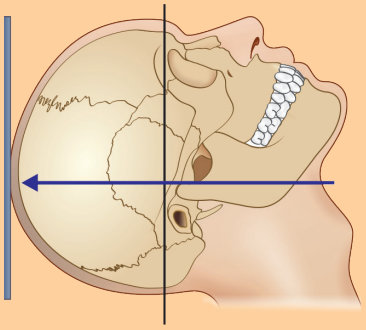
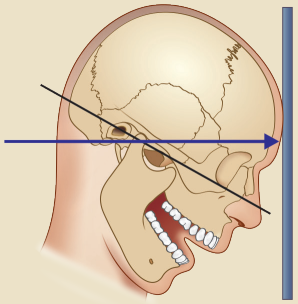
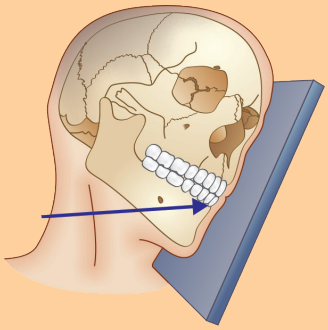
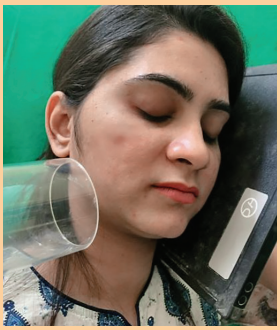
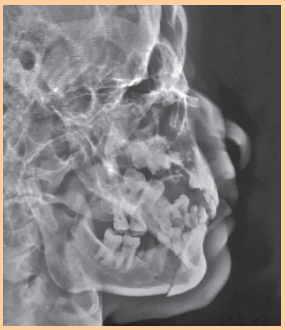
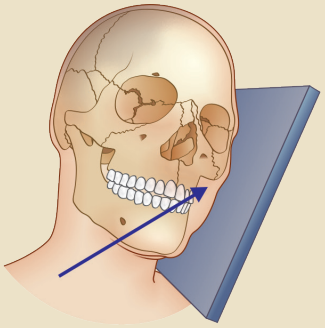
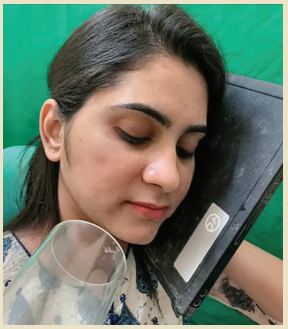
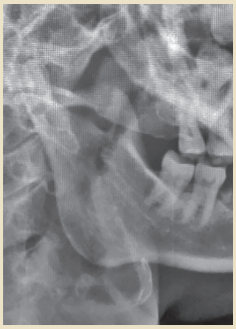
Maxillofacial Imaging view	*Patient's position*	*Film position*	*Central ray*	*Indication/structure seen*
Reverse Towne's (PA) view	▪ Head tipped forward with mouth opened ▪ FH plane is perpendicular to receptor ▪ Opening the mouth positions the condyles out of glenoid fossa which helps in their visualization	▪ In front of the patient	▪ Beam aims upwards 30° to FH plane through line joining the condyles in center	▪ Condylar heads and neck (bilaterally)

TABLE 34.6: Various radiographic technique

Maxillofacial imaging view	*Beam and patient position*	*Images*	*Radiographs*
Lateral cephalogram			
PA skull			
Water's view			

Contd.

TABLE 34.6: Various radiographic techniques *(Contd.)*

Maxillofacial imaging view	*Beam and patient position*	*Images*	*Radiographs*
SMV			
Reverse Towne's view			
Lateral oblique projection—body of mandible			
Lateral oblique projection—ramus			

with first triangle present in the enamel. The base of the lesion is located in the dentin and apex points towards the pulp space and it is confined to the inner half of the dentin. The second triangular shaped lesion is usually large in appearance and it spreads laterally along the direction of the dentinal tubules. As the lesion progresses, there is more amount of demineralization occurring, lesion may appear more diffused and irregular in shape (Fig. 38.6).

Fig. 38.6: Advanced proximal carious lesions

d. **Severe lesions:** These lesions extend beyond more than half of dentin and approaching the pulp chamber. These lesions appears as cavitations in the tooth when clinically examined.

Differential diagnosis: Proximal lesions are smooth surface lesions located typically at or below the tooth contact area and the free gingival margins. Lesion does not start below gingival margins, is a differentiating feature when compared to location of cervical burnouts (Figs 38.7 and 38.8).

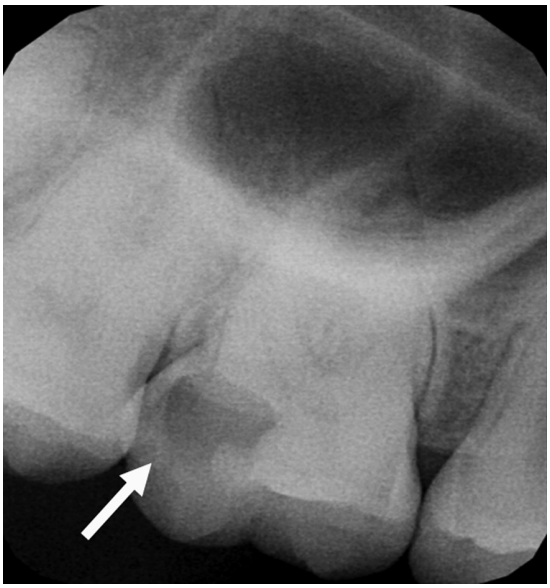


Fig. 38.7

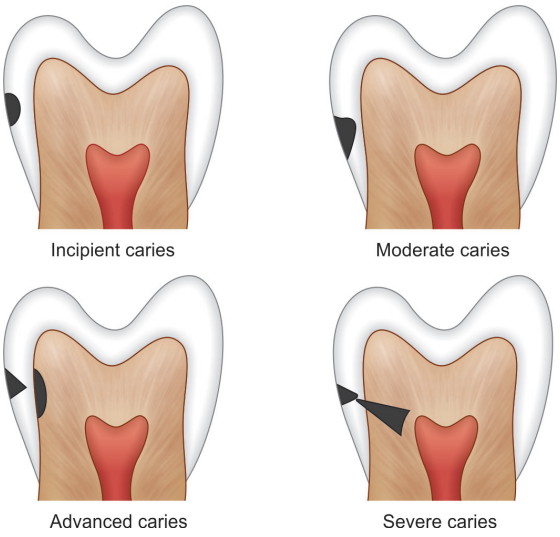


Fig. 38.8: Progression of proximal caries

Buccal and Lingual Surface Caries/ Cervical Caries (Fig. 38.9)

Buccal and lingual surfaces are involved with the carious process where enamel pits are affected by the carious process. These lesions

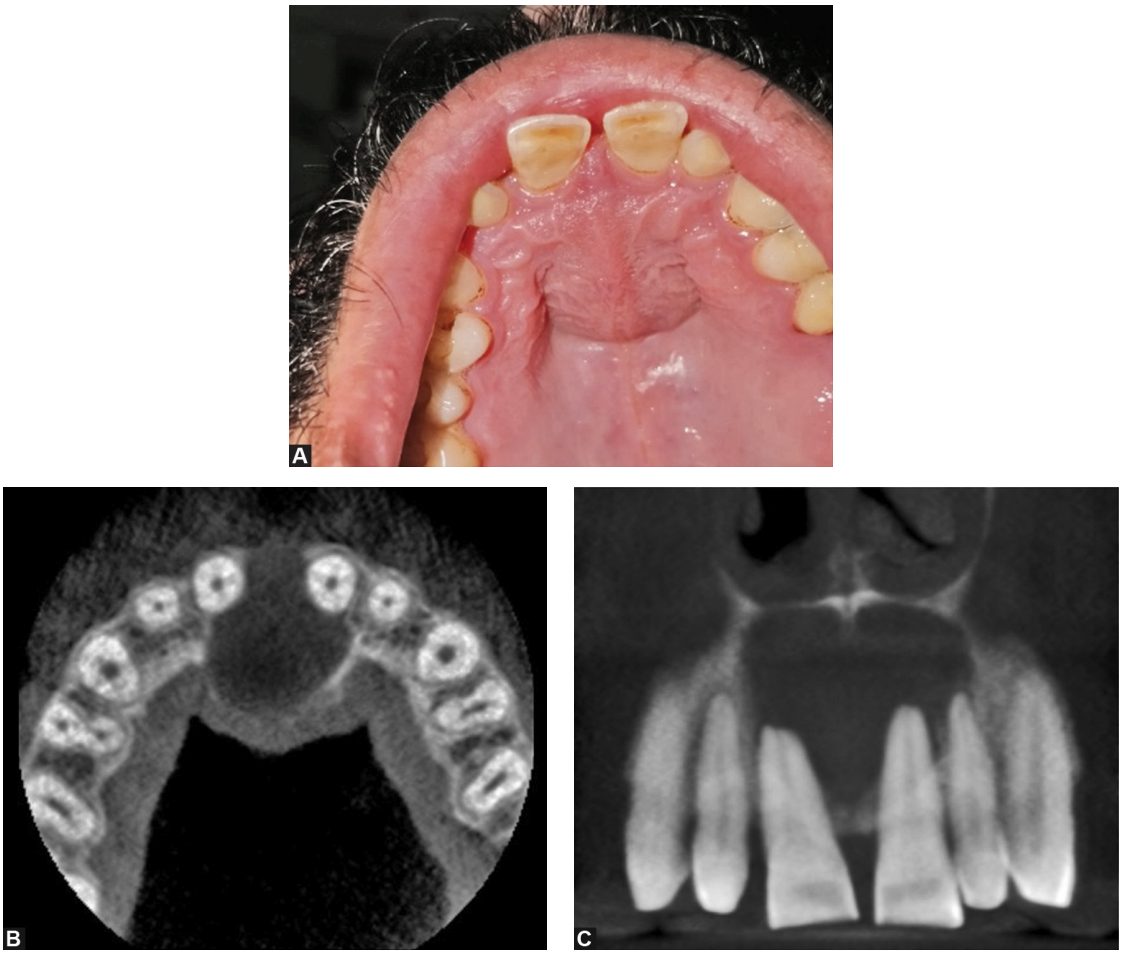


Fig. 41.7: A. Clinical presentation of cyst. **B. and C.** Axial and coronal sections of CBCT showing osteolytic cystic lesion

Management: The nasopalatine cyst is treated with enucleation in case of small cyst and with marsupialization, when it is large in size.

Nasolabial Cyst

It is also called nasoalveolar cyst. The exact origin of nasolabial cyst is unknown. It is a non-odontogenic cyst of developmental origin. It is said to be fissural cyst originating from the epithelial rests in fusion lines of the globular, lateral nasal, and maxillary processes.

Clinical features: Nasolabial cyst can occur in patients with the age range from 12 to 75 years, with a mean age of 44 years. About 75% of these lesions occur in females. There is a slight, unilateral swelling causing the obliteration of nasolabial fold, and the patient may complain of pain or discomfort. When large, it may bulge into the floor of the nasal cavity; distorts the nostrils and causes fullness of the upper lip. Infected cyst may drain into the nasal cavity.

Radiographic features: Nasolabial cyst is primarily soft tissue lesion seen adjacent to the alveolar process above the apices of the incisors. Conventional radiographs may not show any detectable changes, as this is a soft tissue lesion. CT or MRI can give an image of soft tissues.