

Introduction to Dental Anatomy, Morphology, and Physiology Curriculum



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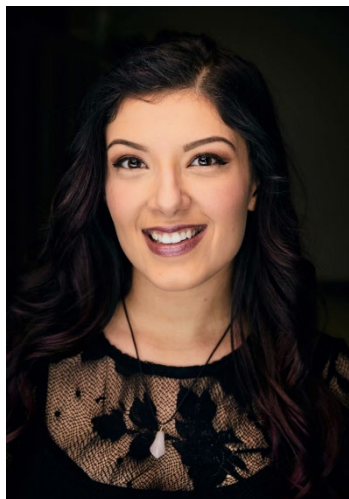
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Introduction to Dental Anatomy, Morphology, and Physiology Curriculum

This curriculum, accompanying a set of 14 models, slide presentations, and printable flashcards will help teach participants basic dental anatomy, morphology, and pathology. Participants will learn to identify various anatomic structures and landmarks of the head and neck, tooth anatomy, and various dental anomalies using the provided models. Participants will understand basic physiological systems as well as their relation to the oral cavity. Finally, participants will also be able to recognize instances of oral pathology.

Curriculum Structure

The *Introduction to Dental Anatomy, Morphology, and Physiology Curriculum* is composed of the following lessons. Approximate lesson times are included.

Lesson	Title	Approximate Time
One	Dental Anatomy	75-100 minutes
Two	Dental Morphology	75-100 minutes
Three	Dental Pathology	75-100 minutes
	Total	3-5 hours

Lesson Structure

Each lesson begins with a Lesson Overview, Lesson Objectives, and a Lesson at a Glance table, listing lesson activities, materials required, suggested preparation steps, and approximate class time.

Lesson Sections

The actual lesson follows the overview, which contains some of the sections described below.

FOCUS

Every lesson begins with a FOCUS activity intended to capture participants' attention. This may be in the form of a small or large class discussion, a game, a demonstration, or a review of previous lesson information. During this activity, participants are introduced to the topic of the lesson.

LEARN

The LEARN activity in each lesson varies in its presentation mode. It may be a slide presentation, group activity, or demonstration.

REVIEW

The majority of lessons end with a REVIEW activity intended to briefly review the lesson's key messages or main points.

Lesson One – Dental Anatomy

Lesson Overview

In this lesson, participants will learn to identify the various anatomical structures of the head and neck, recognize normal anatomy and assess clinical considerations for each structure, and understand basic physiologic functions in regard to their dental relations.

Lesson Objectives

After completing this lesson, participants will be able to:

- Understand basic physiologic systems (circulatory, lymphatic, nervous, muscular, and skeletal) and how they interact in the neck and head area
- Identify structures in the head and neck
- Identify normal anatomy and various anatomical landmarks of the mandible, maxilla, and oral cavity

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• Anatomical models	1. Set out models for Dental Anatomy content: Upper Jaw and Mandible Models, Six Times Normal Tooth Anatomy Model, Sagittal Head Model, Oversize Tongue Model, and Human Skull Model	10 minutes
LEARN	• <i>Dental Anatomy</i> slide presentation • <i>Dental Anatomy Presentation Guide</i> • <i>Dental Anatomy Presentation Guide – Answer Key</i>	1. Prepare <i>Dental Anatomy</i> slide presentation for viewing 2. Print the <i>Dental Anatomy Presentation Guide</i> (one per participant)	45 minutes
REVIEW	• Vocabulary flashcards • Anatomical models • <i>Dental Anatomy Quiz</i> • <i>Dental Anatomy Quiz – Answer Key</i>	1. Transfer the vocabulary list onto printable flashcards 2. Print vocabulary flashcards 3. Print the <i>Dental Anatomy Quiz</i> (one per participant)	20-30 minutes

Instructor Note: Focus activities should tie into review. Have participants examine models at the beginning of the lesson and then try to identify landmarks from the vocabulary flashcards on the models during the review.

Lesson One – Dental Anatomy

FOCUS: Getting Familiar with Anatomical Landmarks on the Models

10 minutes

Purpose:

Participants work in groups to examine the models used for this content, getting familiar with different landmarks and testing what they are already able to identify.

Materials:

- Upper Jaw and Mandible Models
- Six Times Normal Tooth Anatomy Model
- Sagittal Head Model
- Oversize Tongue Model
- Human Skull Model

Facilitation Steps:

1. Set the models out on various tables before or at the beginning of class.
2. Divide participants into groups to move around each table, examining the models.
3. Have participants examine each model and attempt to identify different landmarks on them. Participants should spend two minutes at each table as this is just to test what they may already know and familiarize themselves with what each structure looks like.

Lesson One – Dental Anatomy

LEARN: Dental Anatomy Lecture

45 minutes

Purpose:

Participants will receive a thorough introduction to basic dental anatomy and physiologic systems, what constitutes as normal anatomy, clinical considerations for each structure, how to identify various landmarks on a model as well as on a radiograph, and the dental relationship between each physiologic system.

Materials:

- *Dental Anatomy* slide presentation
- *Dental Anatomy Presentation Guide*
- *Dental Anatomy Presentation Guide – Answer Key*

Facilitation Steps:

1. Share the following information as you show the slide presentation. Give each participant the *Dental Anatomy Presentation Guide* for notetaking during the presentation.

Slide 1: Introduction slide.

Slide 2: Goals and Objectives

The goals and objectives for this lesson are for participants to understand basic physiologic systems (circulatory, lymphatic, nervous, muscular, and skeletal) and how they interact in the neck and head area, to identify structures in the head and neck, and to identify normal anatomy and various anatomical landmarks of the mandible, maxilla, and oral cavity.

Slide 3: Regions of the Face

Dental professionals must be familiar with the anatomy of the head and neck so they may be able to confidently identify abnormalities. Visual and palpable examination of these accessible features give the dental professional information about the health of deeper tissue. There may be some degree of variation in different anatomies, within a normal range. However, a significant change may indicate and signal a condition present in the patient. These changes in features must be documented and

followed up by the examining dental professional. The regions of the face include:

- Frontal
- Orbital
- Nasal
- Infraorbital
- Zygomatic
- Buccal
- Oral
- Mental

Slide 4: Frontal and Orbital Regions

- **Frontal region:** the region of face that includes forehead and area above the eyes
- **Orbital Region:** the facial region that includes bony orbit and eyeball
 - The eyeball and its supporting structures contained in the orbit of the skull
- **Orbit:** bony eye socket

Slide 5: Nasal Region

- **Nasal Region:** the region of the face occupied by the external nose
- **External nose:** surface of the nose in the nasal region
- **Root of the nose:** nose located between the eyes
- **Apex of the nose:** tip of nose
- **Naris (nares, plural):** nostrils of nose, inferior to the apex on either side of the nose
- **Nasal septum:** midline part of the nose that separates the nares
- **Ala (alae, plural):** wing-like cartilaginous structure(s) bounding nares laterally

Slide 6: Infraorbital and Zygomatic Regions

- **Infraorbital Region:** the facial region located both inferior to orbital region and lateral to nasal region
- **Zygomatic Region:** the facial region that overlies zygomatic arch
- **Zygomatic arch:** bony support for cheek; extends from just below the lateral margin of the eye toward the middle part of the external ear
- **Temporomandibular joint (TMJ):** joint where temporal bone of the skull articulates with mandible; movements of the jaw occur when the mouth is opened and closed using the lower jaw or when the lower jaw is moved to the left or right

Slide 7: Buccal Region

- **Buccal Region:** structures on facial surface of tooth close to inner cheek composed of the soft tissue of the cheek; most of upper cheek is fleshy, mainly formed by a mass of fat and muscles
- **Masseter muscle:** powerful bilateral muscle of mastication
- **Mastication:** chewing process
- **Angle of the mandible:** thickened area on posterior-inferior border of mandibular ramus

Slides 8-9: Oral Region

The upper and lower lips are fleshy folds that mark the entrance to the oral cavity proper.

- **Oral Region:** the region of face that contains the lips and oral cavity
- **Maxilla:** upper jaw
- **Mandible:** lower jaw

Between the vermilion zone and the inner oral cavity is the intermediate zone.

- **Vermilion zone:** darker appearance of the lips with its outlining mucocutaneous junction at the vermilion border as compared with surrounding skin

- **Mucocutaneous junction:** transition zone at the vermilion border, outlining the lips from the surrounding skin
- **Philtrum:** vertical groove on midline of upper lip extending downward from the nasal septum
- **Tubercle of the upper lip:** midline thickening of upper lip
- **Labial commissure:** corner of the mouth where the upper and lower lips meet

Slide 10: Mental Region

- **Mental region:** the region of face with the chin as the major feature
- **Mandibular symphysis:** midline area of mandible, marking fusion of the two mandibular processes
- **Ramus:** stout, flat plate(s) that extend(s) upward and backward from the body of the mandible on each side
- **Coronoid process:** bony projection at anterior border of mandibular ramus; thin, sharp margin at the anterior border of the ramus that terminates in the coronoid process
- **Coronoid notch:** main part of the anterior border of the ramus, forming a concave forward curve
- **Mandibular condyle:** bony projection off posterior and superior thickened border of mandibular ramus
- **Mandibular notch:** depression between coronoid process and condyle

*See the Upper Jaw and Mandible Model

Slide 11: Regions of the Neck

This region also houses some of the major glands including:

- **Thyroid gland:** the endocrine gland in neck
- **Parathyroid glands:** the endocrine glands along the posterior aspects of the thyroid
- **Submandibular salivary gland:** a major salivary gland located in the neck

- **Sublingual salivary gland:** a major salivary gland located in the neck

The associated glands will be covered later in the presentation.

*See Sagittal Head Model

Slide 12: Golden Proportions

- **Golden proportions:** the principle that provides a guide for aesthetically pleasing proportion of the face; allows comparison of the three divisions of the face for functional and aesthetic purposes
- **Vertical dimensions of the face:** dividing face into three horizontal parts

Slide 13: Clinical Considerations for the Dental Professional

The only way to determine and verify pathology in the soft tissue around the vermilion border is with a tissue biopsy and microscopic examination. The dental professional should encourage tobacco cessation and protection of the lips with sunscreen, lip balm with SPF, etc. The dental professional should also record any variation from the normal such as scar tissue from a traumatic accident or a history of a cleft lip.

Disruption of the vermilion zone:

- Changes may be benign and the result of scar tissue from past traumatic accidents, developmental disturbances, or cellular changes such as those that occur from sun damage
- Changes may also represent more serious conditions, such as cancer
- Increased risk of cancer comes from increased sun exposure and tobacco use

Slide 14: The Oral Cavity

- The oral cavity is divided into vestibules, jaws and alveolar processes, teeth, and the oral cavity proper
- The landmark boundaries of the oral cavity are:

- The lips of the face mark the anterior boundary of the oral cavity
- The pharynx (throat) marks the posterior boundary of the oral cavity
- The cheeks mark the lateral boundaries
- The palate marks the superior boundary
- The floor of mouth marks the inferior boundary

Slide 15: Orientational Terms for the Oral Cavity

Oral structures are identified with orientational terms based on their relationship to other orofacial structures (facial surface, lips, cheek, tongue, palate).

- **Facial:** structures closest to the facial surface
- **Labial:** structures closest to the lips
- **Buccal:** structures closest to the cheeks
- **Lingual:** structures closest to the tongue
- **Palatal:** structures closest to the palate

Slide 16: Oral Vestibules

- **Oral vestibules:** upper and lower (maxillary and mandibular) horseshoe-shaped spaces within the oral cavity, between the lips and cheeks anteriorly and laterally (and the teeth and their soft tissue medially and posteriorly)

Vestibules are lined by the following mucous membranes:

- **Oral mucosa:** mucosa or mucous membrane lining oral cavity
- **Labial mucosa:** mucosal lining of inner parts of the lips
- **Buccal mucosa:** mucosa that lines inner cheek
- **Alveolar mucosa:** oral mucosa immediately apical to mucogingival junction, redder in color than pink labial and buccal mucosa

Labial and buccal mucosa are continuous and equally pink; however, coloration may vary in individuals with pigmented skin.

Slide 17: Additional Oral Cavity Anatomy

- **Buccal fat pad:** dense pad of underlying adipose (fat) connective tissue at the posterior part of each vestibule; acts as protective cushion during mastication
- **Parotid papilla:** small elevation of tissue on inner part of the buccal mucosa, just opposite the maxillary second molar, that protects the opening of the parotid duct
- **Parotid duct (aka Stensen duct):** duct associated with parotid salivary gland
- **Vestibular fornix:** deepest recess of each vestibule
- **Mucobuccal fold:** area within vestibule where labial mucosa or buccal mucosa meets alveolar mucosa
- **Labial frenum (frena, plural):** fold(s) of tissue located at midline between labial mucosa and alveolar mucosa on the upper and lower dental arch(es)

A labial frenum is displayed in the image on the slide.

Slide 18: Jaws, Alveolar Processes, and Teeth

The jaw is comprised of two major components: the maxilla and the mandible.

Maxilla: Consists of two maxillary bones sutured together during development, unmovable in articulation, contains many facial and skull bones, each maxillary bone contains a body and four processes

Mandible: Singular bone, movable articulation with the temporal bones at each temporomandibular joint (TMJ)

*See Upper Jaw and Mandible Models

Slide 19: Maxilla

Important anatomical landmarks of the maxilla:

- **Body of maxilla:** horizontal part of upper jaw superior to teeth

- **Maxillary sinus:** paranasal sinus within maxilla

Slide 20: Mandible

Important anatomical landmarks of the mandible include the:

- **Body of mandible:** heavy, horizontal part of lower jaw inferior to teeth
- **Alveolar process (aka alveolar bone):** dental arch or tooth-bearing part of each jaw that contains alveoli; bony extension for both the maxilla and mandible that contain each tooth socket
- **Alveolus (alveoli, plural):** socket(s) of tooth
- **Canine eminence:** vertically oriented and labially placed bony ridge of alveolar process, especially prominent on each side of the maxilla
- **Periodontal ligament (PDL):** fibrous ligament surrounding the teeth that supports and attaches them to alveoli bony surface; allows slight tooth movement within the alveolus while still supporting the tooth

*See Upper Jaw and Mandible Models

Slide 21: Clinical Considerations of the Hard Tissue

The following clinical considerations are normal variations of hard tissue but should still be noted by the dental professional. Exostoses appear radiopaque (light) radiographically. Depending on extent of size, they may interfere with radiographic analysis and/or restorative/periodontal therapies and thus should be noted but are still within normal limits anatomically.

Tori (both mandibular and palatal) are also seen as radiopaque (light) masses on X-rays. They may become large enough where they can interfere with speech, oral hygiene procedures, radiographic film/sensor placement and analysis, and prosthesis therapy of the mandibular alveolar process (think night guards, dentures, etc.).

In severe cases where interference affects quality of treatment/home care, excision may be necessary. It is important to note that tori may grow back after excision, so growth should be continually monitored.

Exostoses: Small, localized, developmental bone growths noted usually on the facial surface of the alveolar process of the maxilla

- Possible hereditary etiology
- Associated with occlusal trauma
- May be single, multiple, unilateral, or bilateral
- Raised, hard
- Located in the premolar to molar region, covered by oral mucosa

Mandibular torus, (tori plural): bone growth(s) noted on the lingual aspect(s) of the mandibular arch

- Similar characteristics as exostosis, but typically seen bilaterally in the area of premolars
- Can present a surface clef
- Lobulated or nodular
- May contact each other at midline
- Covered in oral mucosa
- Slow growing, asymptomatic

Palatal torus: normal variation of bone growth noted on the midline of the hard palate

Slide 22: Anatomy of a Tooth

Each fully erupted and mature tooth consists of two major parts: the crown and the root.

- **Crown:** part of tooth composed of dentin and pulp covered by enamel
- **Root:** part of a tooth composed of dentin covered by cementum
- **Enamel:** extremely hard outer layer of tooth crown
- **Dentin:** moderately hard inner layer of tooth crown overlying pulp

- **Pulp:** soft innermost connective tissue in both crown and root
- **Cementum:** outermost layer of the root of a tooth; the part of the tooth that attaches to the PDL, which then attaches to the alveolus of bone, holding the tooth in its socket

*See Six Times Normal Tooth Anatomy Model

Slide 23: Dental Arches

Dental arches: Alveolar process or tooth-bearing part of each jaw in either the **maxillary** or **mandibular arch**

Identifiable landmarks around each arch:

- **Maxillary tuberosity:** tissue-covered bony elevation just distal to last tooth of maxillary arch
- **Retromolar pad:** dense pad of tissue just distal to last tooth of mandibular arch

*See Upper Jaw and Mandible Models

Slide 24: Primary Teeth

Also known as the primary dentition, deciduous teeth, and baby teeth.

Primary teeth are the first teeth present. Children present with **incisors**, **canines**, and **molars**

- **Incisors:** first and second anterior teeth from midline (centrals and laterals)
- **Canines:** anterior teeth that are the third from midline in each quadrant
- **Molars:** most posterior teeth with firsts, seconds, and thirds

Slide 25: Permanent Teeth

Also known as permanent dentition or adult teeth.

Adult molars do not have a deciduous counterpart, meaning the premolars in the permanent dentition replace the primary molars in the primary dentition. As the jaw expands and more room is made in the oral cavity, the first, second and third molars erupt

posterior to the premolars in the permanent dentition.

- Second and final dentition with all the permanent/adult teeth present
- Adults present with the same types of teeth as adolescents, plus **premolars**
- **Premolars:** fourth and fifth posterior teeth from midline in permanent dentition, including firsts and seconds or bicuspid
- **Anterior teeth:** incisors and canines at front of the oral cavity
- **Posterior teeth:** premolars and molars in the back of the mouth

Slides 26-27: Gingival Tissue

- **Gingiva:** gum tissue composed of mucosa surrounding the maxillary and mandibular teeth while covering the alveolar processes
- **Attached gingiva:** gingiva that tightly adheres to alveolar process around the roots of teeth; firmer and pinker than redder and movable alveolar mucosa
- **Mucogingival junction:** scallop-shaped line of demarcation between attached gingiva and alveolar mucosa
- **Marginal gingiva:** gingiva at the gingival margin of each tooth; forms a cuff above the neck of the tooth
- **Free gingival groove:** groove that separates attached gingiva from marginal gingiva; varies in depth according to the area of the oral cavity; especially prominent on mandibular anterior teeth and premolars
- **Free gingival crest:** most coronal part of marginal gingiva
- **Interdental gingiva:** gingival tissue between adjacent teeth adjoining attached gingiva
- **Interdental papilla:** individual extensions of the interdental gingiva between adjacent teeth adjoining attached gingiva
- **Gingival sulcus:** space facing the sulcular gingiva
- **Melanin pigmentation:** localized macules of pigmentation caused by the presence of

melanin; found on attached gingiva, especially at the base of the interdental papillae

Slide 28: Clinical Considerations of the Soft Tissue

The following clinical considerations are normal variations of soft tissue but should still be noted by the dental professional. The one thing to keep in mind when linea alba is present, is that excess hyperkeratinized tissue may be associated with certain oral parafunctional habits, such as bruxism (clenching, grinding, etc.).

If you see a patient who has a prominent linea alba or consistently presents with the ridge each time they come in, likely this patient clenches/grinds frequently. An oral device such as a night guard should be suggested for this type of patient to protect the integrity of their teeth and the surrounding soft tissue.

Fordyce granules: small, yellowish elevations of sebaceous glands on oral mucosa

- Commonly found on labial and buccal mucosa
- The spots represent deeper deposits of sebum from trapped or misplaced sebaceous gland tissue, usually associated with hair follicles
- They become more prominent with age due to thinning of the overlying tissue

Linea alba: White ridge of keratinized epithelium (calloused tissue) that extends horizontally on the buccal mucosa at the level where teeth occlude (come together)

- Commonly found on buccal mucosa
- Can sometimes be present on tongue's perimeter as well
- Excess can be associated with certain oral parafunctional habits, such as bruxism (clenching, grinding, etc.)

Slide 29: Oral Cavity Proper

The oral cavity proper includes the palate, tongue, and floor of the mouth. It is closed anteriorly by dental arches.

- **Oral cavity proper:** the inside of the mouth
- **Fauces:** opening posteriorly from the oral cavity proper into the pharynx/throat; formed laterally on each side by faucial pillars
- **Anterior faucial pillar:** anterior lateral folds of tissue in the pharynx created by underlying muscle forming the fauces
- **Posterior faucial pillar:** posterior lateral folds of tissue in the pharynx created by underlying muscle forming the fauces
- **Palatine tonsils:** tonsillar tissue located between faucial pillars (aka tonsils”) can become enlarged when involved with inflammation

Slide 30: Anatomy of the Palate

The palate is the roof of the mouth. It separates the oral cavity from the nasal cavity. It has two parts: the anterior palate and the posterior palate.

- **Hard palate:** firmer anterior part of the palate
- **Soft palate:** looser posterior part of the palate
- **Median palatine raphe:** midline ridge of tissue on the hard palate that overlies the bony fusion of the palate; marked by median palatine suture
- **Incisive papilla:** small bulge of tissue at the most anterior part of the hard palate, lingual to the anterior teeth
- **Palatine rugae:** firm, irregular ridges of tissue directly posterior to the incisive papilla, radiating from the incisive papilla and raphe
- **Uvula:** midline muscular structure hanging down from the posterior margin of the soft palate

- **Pterygomandibular fold:** tissue fold that extends from the junction of the hard and soft palates down to the mandible, just behind the most distal mandibular tooth; stretches when the mouth is opened wider; separates the cheek from the throat

Slides 31-34: Anatomy of the Tongue

The tongue is a structure in the oral cavity consisting of muscle and covered by oral mucosa.

*See Oversize Tongue Model

- **Base of tongue:** most posterior part of tongue; pharyngeal part of tongue; attaches to the floor of the mouth; does not lie within the oral cavity proper but within the oral part of the throat
- **Body of tongue:** anterior part of the tongue; lies within the oral cavity proper
- **Apex of tongue:** tip of the tongue
- **Dorsal surface of tongue:** top surface of the tongue
- **Median lingual sulcus:** midline depression on dorsal surface of tongue
- **Lingual papillae:** small, elevated structures of specialized mucosa on the tongue; some of which are associated with taste buds
- **Filiform lingual papillae:** slender, thread-like lingual papilla giving dorsal surface of tongue its velvety texture
- **Fungiform lingual papillae:** reddish, smaller, mushroom-shaped lingual papillae on the dorsal tongue surface
- **Sulcus terminalis:** inverted, V-shaped groove located posteriorly on dorsal tongue surface; separates the base from the body of the tongue, demarcating a line of fusion of tissue during the tongue’s development
- **Circumvallate lingual papillae:** 10-14 larger, mushroom-shaped lingual papillae that line up along the anterior side of the sulcus terminalis on the tongue

- **Foramen cecum:** small, pit-like depression located where sulcus terminalis points backward toward the pharynx
- **Lingual tonsil:** irregular mass of tonsillar tissue located posteriorly on the dorsal surface of the tongue

The ventral surface of the tongue presents with large, visible blood vessels, the deep lingual veins, which pass close to the surface.

- **Lateral surface of tongue:** side of the tongue
- **Foliate lingual papillae:** vertical ridges of lingual papillae on the lateral tongue surface
- **Ventral surface of tongue:** underside of the tongue
- **Plica fimbriata (plicae fimbriatae, plural):** fold(s) with fringelike projections on the ventral surface of the tongue lateral to each deep lingual vein

Slide 35: Floor of the Mouth

The floor of the mouth is an area of the oral cavity proper underneath the ventral surface of the tongue and bordered by the mandibular arch.

- **Lingual frenum:** midline fold of tissue between the ventral surface of the tongue and the floor of the mouth
- **Sublingual fold:** ridge of tissue on each side of the floor of the mouth; joins in a V-shaped configuration extending from the lingual frenum to the base of the tongue; contains openings of the sublingual duct from the sublingual salivary gland
- **Sublingual caruncle:** small papilla at the anterior end of each sublingual fold; contains openings of the ducts
- **Submandibular duct (aka Wharton duct):** duct associated with the submandibular gland
- **Sublingual duct (aka Bartholin duct):** short duct associated with the sublingual gland

Slide 36: Pharyngeal Divisions

The pharynx is a muscular tube of the neck or throat. It has both respiratory and digestive system functions.

*See Sagittal Head Model

- **Pharyngeal divisions:** nasopharynx, oropharynx, and laryngopharynx
- **Pharynx:** muscular tube of the neck of throat; has both respiratory and digestive system functions
- **Nasopharynx:** division of pharynx superior to level of soft palate, continuous with the nasal cavity; only partially visible by dental professionals
- **Oropharynx:** oral division of pharynx, between the soft palate and the opening of the larynx; fauces mark the boundary between the oropharynx and the oral cavity proper; visible by dental professionals
- **Laryngopharynx:** most inferior part of pharynx close to laryngeal opening; special diagnostic tools are needed to examine this division

Slide 37: Glands

Sensory nerves are also present in endocrine glands. There are motor nerves associated with both exocrine and endocrine glands that help to regulate the flow of the secretion. Salivary glands are classified as either major or minor depending on their size. Both major and minor salivary glands are exocrine glands with associated ducts that help convey the saliva directly into the oral cavity.

- **Gland:** a structure that produces a secretion necessary for normal body functions
- **Exocrine gland:** a gland with a duct associated with it
- **Duct:** a passageway that allows the glandular secretion to be emptied directly into the location where the secretion is to be used
- **Endocrine gland:** a ductless gland with its secretions conveyed directly into the blood,

and then carried by the blood vessels to some distant location to be used

- **Salivary gland:** glands that produce saliva

Slide 38: Functions of Saliva

Saliva is a secretion controlled by the autonomic nervous system. It contains minerals, electrolytes, proteins, buffers, enzymes, immunoglobulins (secretory IgA), and metabolic wastes.

Considerations for saliva: Saliva is the first step of dental biofilm formation since it contributes to the salivary pellicle that develops on a tooth and on oral mucosa. Saliva also supplies the minerals for supragingival calculus formation, so while it has many beneficial properties within the oral cavity, it also may cause hygiene issues if it is present in excess.

1. Serves as lubrication to protect from dryness
2. Cleanses the oral mucosa to protect from potential carcinogens by way of its mucins and other glycoproteins
3. Aids in food digestion
4. Serves as buffer providing protection of oral mucosa against acids from food products and dental biofilm and then later the stomach lining
5. Involved in antibacterial activity through its lysozyme content as well as secretory IgA; the glycoprotein of lactoferrin content inhibits growth of bacteria
6. Helps maintain tooth integrity (involved in the post-eruptive maturation of enamel)
7. Helps with remineralization of the tooth surface because it is supersaturated with calcium and phosphate ions

Slides 39-40: Anatomy of a Salivary Gland

Salivary glands are composed of both epithelium and connective tissue. Epithelial cells line the ducts and produce saliva. These cells are known as the secretory cells and are found in groups known as acini. Each acinus consists of a single layer of cuboidal epithelial cells surrounding a lumen.

- **Secretory cells:** epithelial cells that produce saliva; classified as either mucous or serous depending on the type of secretion produced
- **Acinus (acini, plural):** group(s) of secretory cells of salivary gland
- **Lumen:** Central opening where saliva is deposited into the duct after production by secretory cells
- **Mucous cells:** secretory cells that produce mucous secretory product with mainly mucins
 - Mucins in saliva lubricate and can form a surface barrier, mucins aid in aggregating microorganisms
- **Serous cells:** secretory cells that produce serous secretory product with proteins and glycoproteins; produce enzyme amylase that catalyzes the hydrolysis of starch into sugars (beginning of chemical process of digestion)

Connective tissue surrounds the epithelium, which protects and supports the gland. Connective tissue is divided into the capsule and the septa.

Divisions of connective tissue in a salivary gland include the:

- **Capsule:** connective tissue that surrounds the outer part of the entire gland
- **Septum (septa, plural):** connective tissue that divides the inner part of the gland into the larger lobes and then smaller lobules
- **Lobes:** large inner parts of glands
- **Lobules:** smaller inner parts of glands

Slide 41: Ductal System of a Gland

A ductal system of salivary glands consists of hollow tubes connected initially with the acinus and then with other ducts as the ducts progressively grow larger from the inner to the outer parts of the gland. The ductal system actively participates in the production and modification of saliva as well as serves as a pipeline for the passageway of saliva. Intercalated ducts serve as a passageway for saliva and contribute many macromolecular components

to the saliva such as lysozyme and lactoferrin which is stored in secretory granules of ductal cells). Striated ducts are connected to the intercalated ducts in the lobules of the gland. Ductal cells actively resorb and secrete electrolytes into the saliva from adjacent blood vessels.

- **Intercalated duct:** duct associated with acinus or terminal part of salivary gland
 - Passageway for saliva
 - Contribute lysozyme and lactoferrin to saliva
- **Striated duct:** larger duct connecting lobules of salivary gland
 - Serve as a passageway for saliva
 - Involved in modification of saliva
- **Excretory duct:** secretory duct; duct of salivary gland through which saliva exits into the oral cavity

Slide 42: Major Salivary Glands

There are three large, paired glands that have named associated ducts: the parotid, submandibular, and sublingual glands. The parotid gland only contains serous acini, making it so the gland secretes a watery serous secretory product as well as enzymes, such as amylase. The duct emerges from the gland and opens into the oral cavity on the inner surface of the buccal mucosa (usually opposite the maxillary second molar at the parotid papilla).

The submandibular gland secretes a more viscous mixed secretory product than the parotid, but it is mostly serous. It travels anteriorly on the floor of the mouth and opens into the oral cavity at each sublingual caruncle.

The sublingual gland secretes a mixed secretory product, predominantly viscous mucous component. This gland opens at same opening as the submandibular duct, at each sublingual caruncle.

- **Parotid:** the largest salivary gland but only provides 25% of total salivary volume

- Located behind the mandibular ramus, anterior and inferior to the ear
- The associated duct is the parotid duct (aka Stensen duct)
- **Submandibular:** the second largest major salivary gland
 - Provides 60-65% of total salivary volume
 - Lies beneath the mandible in the submandibular fossa, posterior to the sublingual salivary gland
 - The associated duct is the submandibular duct (aka Wharton duct)
- **Sublingual:** the smallest, most diffuse gland
 - The only gland without a capsule
 - Provides only 10% of the total salivary volume
 - Located in the sublingual fossa, anterior to the submandibular salivary gland on the floor of the mouth
 - Associated duct is the sublingual duct (aka Bartholin duct)

Slide 43: Minor Salivary Glands

Minor salivary glands are small with short, unnamed ducts, much smaller and shorter than the major salivary glands but are more numerous. They reach the oral cavity through the short ducts that open directly onto the oral mucosal surface (scattered in buccal, labial, and lingual tissue as well as on the soft palate, the lateral zones of hard palate, and the floor of the mouth). Minor salivary glands secrete a mostly viscous mucous secretory product with a slight serous influence.

The secretions provided by these glands protect and moisten the oral mucosa, especially at night when the major salivary glands are mostly inactive. The salivary flow of the von Ebner salivary glands flush the trough around the circumvallate lingual papillae and allow for new taste sensations.

- Small with short, unnamed ducts (smaller and shorter than major salivary glands)
- More numerous ducts
- Provide a continuous, slow secretory flow which serves an important role in protecting and moistening the oral mucosa
- **Von Ebner salivary glands:** serous minor salivary glands associated with circumvallate lingual papillae
 - Flush out and allow for new taste sensations

Slide 44: Clinical Considerations for Salivary Gland Pathology

During the aging process, there is a generalized loss of salivary gland tissue (30-60%) as well as changes of the ductal system. Stimulated saliva production may lessen in older individuals. Certain medications, disease processes, or destruction of salivary tissue may result in a decreased production of saliva. Hyposalivation is the decreased production of saliva. Disease processes that can cause hyposalivation include diabetes, Sjögren syndrome, and rheumatoid arthritis. Destruction occurs after radiation therapy for head and neck cancer because the salivary glands often are in the radiation field, and its cells are highly sensitive.

Series of chemotherapies for cancer or bone marrow transplantation also may cause reduced salivary function. Xerostomia can result in increased trauma to a nonprotected oral mucosa, increased cervical caries, speech and mastication problems, and halitosis (bad breath). Salivary glands may also become blocked, which stops the drainage of saliva from the duct; this may cause glandular enlargement and tenderness. Blockage may result from either a stone (aka sialolith) formation or trauma to the duct opening on the surface of the oral cavity, such as from cheek biting. Removal of the stone is the treatment for both conditions listed above. Removal of the entire salivary gland may be necessary in severe cases.

Nicotinic stomatitis also causes inflammation to duct openings, which then become dilated and can be seen clinically as red macules scattered on the

palatal oral mucosa. Saliva is used successfully as a screening test due to the ease and low cost of testing with which the sample can be obtained and due to the collection of the sample being noninvasive in nature. Saliva can be used to screen for drug usage, systemic diseases, changes in physiological and psychological states, and oral cancer.

Hyposalivation: decreased production of saliva

Xerostomia: dry mouth

Mucocele: lesion due to retention of saliva in the minor salivary gland

Ranula: lesion due to retention of saliva usually in the submandibular salivary gland

Nicotinic stomatitis: whitish lesion on the hard palate caused by chronic heat production from smoking or hot liquid consumption

Slide 45: Thyroid Gland Properties

The thyroid gland is the largest endocrine gland. It is in the anterior and lateral regions of the neck, inferior to the thyroid cartilage.

- Ductless
- Produces and secretes its own products and hormones directly into the blood
- **Thyroxine:** hormone from the thyroid gland that stimulates the metabolic rate
- Covered by a connective tissue capsule that extends into the gland by the septa
- Septa divide into larger lobes and then smaller lobules
- Each lobule is composed of follicles
- **Follicles:** masses embedded in meshwork of reticular fibers within lobules of the thyroid
- **Colloid:** material in follicles of the thyroid reserved for production of thyroxine

Slide 46: Clinical Considerations for Thyroid Gland Pathology

The thyroid may become enlarged during a disease process involving the gland, such as an endocrine disorder.

Goiter: enlarged thyroid gland

Slides 47-48: Lymph Properties

Each lymphatic vessel drains its region. All these vessels communicate with each other. Lymph nodes are small, soft, and free/mobile in the surrounding tissue of a healthy patient. Lymph nodes are positioned to filter toxic products from the lymph to prevent their entry into the blood system. Lymph nodes are palpable on a patient in the cervical region and should be evaluated in an extraoral examination to ensure they are within normal limits.

- **Lymphatic(s):** network of lymphatic vessels that collect and transport lymph, linking lymph node; part of the immune system and helps fight disease processes
- **Tonsillar tissue:** nonencapsulated masses of lymphoid tissue
- **Lymphatic vessels:** system of endothelium-lined channels that carry lymph; parallel to the venous blood vessels in location but are more numerous
- **Lymph:** tissue fluid that drains from the surrounding region into lymphatic vessels
- **Lymphatic ducts:** ducts that smaller lymphatic vessels containing lymph converge into and then empty into the venous system
- **Lymph nodes:** bean-shaped filtering bodies grouped in clusters along connecting lymphatic vessels

Each lymph node is composed of organized lymphoid tissue and contains lymphocytes that actively filter toxic products from the lymph. Each node is surrounded by a capsule with bands of connective tissue, the trabeculae, which extend from the capsule into the node. Mature lymphocytes are of the B-cell type and are mainly involved in the humoral immune response with immunoglobulin production by the plasma cells.

Tonsils contain lymphocytes that remove toxic products similar to lymph nodes, but, unlike lymph nodes, tonsils are situated near airway and food

passages to protect the body against disease processes from the related toxins.

- **Afferent vessels:** lymphatic vessels that allow the flow of lymph into lymph node
- **Hilus:** depression on one side of a lymph node
- **Efferent vessel:** lymphatic vessel in which lymph flows out of a lymph node
- **Trabeculae:** joined matrix pieces forming a lattice in cancellous bone or bands of connective tissue in the lymph node that separate lymphatic nodules
- **Lymphatic nodules:** masses of lymphocytes in the lymph node
- **Germinal center:** center region of the lymphatic nodule of a lymph node where lymphocytes mature
- **Pharyngeal tonsils:** located on the superior and posterior walls of the nasopharynx behind the uvula

Slide 49: Clinical Considerations for Lymphoid Tissue Pathology

A region's lymph nodes respond when a patient has an active disease process, such as an infection. With more and larger lymphocytes, the lymphoid tissue can better fight the disease process. Intraoral tonsillar tissue may become enlarged and inflamed as well, which may cause tenderness when swallowing; severe cases may cause airway obstruction. A lymphatic response is also triggered by active periodontal disease, which attracts other inflammatory mediators to the damaged and infected site (the gingiva).

Lymphadenopathy: enlarged and palpable lymph nodes; results due to an increase in the size of each individual lymphocyte as well as the overall cell count in the lymphoid tissue

- Intraoral tonsillar tissue may become enlarged and inflamed
- May cause tenderness when swallowing
- May cause airway obstruction
- Response also triggered by active periodontal disease

Slide 50: Nasal Cavity Properties

Beneath each concha are openings through which the paranasal sinuses or nasolacrimal ducts communicate with the nasal cavity. The posterior part of the nasal cavity communicates with the nasopharynx and then with the rest of the respiratory system. Moist mucus provides a superficial coating that is moved by ciliary action posteriorly to the nasopharynx, where it is either expectorated or swallowed.

This mucosa is also extremely vascular, allowing it to warm the incoming breathed air. The engorgement of erectile tissue happens in periodic intervals of 30-60 minutes where it closes off the involved side of the nasal cavity to allow the respiratory mucosa to recover from the effects of dryness during respiration.

- **Nasal cavity:** inner space of the nose
- **Nasal conchae:** projecting structures that extend inward from each lateral wall of the nasal cavity
- **Respiratory mucosa:** mucosa that lines the nasal cavity, consisting of pseudostratified ciliated columnar epithelium
- **Goblet cells:** cells in respiratory mucosa that produce mucus for moisture and to provide humidity as well as trap any foreign materials from the air
- **Olfactory mucosa:** mucosa in the roof of each part of the nasal cavity that carries sense of smell receptors
- **Erectile tissue:** extensive, superficial plexus of large, thin-walled vessels in nasal cavity capable of considerable engorgement

Slide 51: Paranasal Sinuses

The paranasal sinuses contain fewer goblet cells than in the nasal cavity, fewer associated glands, and do not have erectile tissue. The sinuses form as outgrowths of the wall of the nasal cavity and become air-filled extensions in the adjacent bones. Maxillary sinuses are small at birth and continue to grow until puberty; they are not fully developed until all the permanent teeth have developed in

early adulthood. Ethmoidal sinuses do not start growing until they are 6-8 years old. Frontal sinuses and sphenoidal sinuses are not present at birth.

At approximately 2 years old, the two anterior ethmoidal sinuses grow into the frontal bone, forming the frontal sinus on each side (this is visible radiographically by age 7). The two posterior ethmoidal sinuses grow into the sphenoid bone and form the sphenoidal sinuses. Growth of sinuses in the size and shape of the face is important during infancy and childhood.

- **Paranasal sinuses:** paired air-filled cavities in bone
 - Includes the frontal, sphenoidal, ethmoidal, and maxillary sinuses
 - Serves to lighten the skull bones, act as sound resonators, and provide mucus for the nasal cavity
 - Communicates with the nasal cavity through small openings in the lateral nasal wall
 - Add resonance in voice during puberty

Slide 52: Clinical Considerations for the Nasal Cavity

Respiratory mucosa of the nasal cavity and paranasal sinuses can become inflamed, and the space congested with mucus due to allergies or respiratory tract infection. Discomfort comes from pressure caused by increased mucus production with nasal or pharyngeal discharge. Treatment involves medications that produce vasoconstriction in the blood vessels while also reducing the amount of mucus produced.

In the case of a periapical abscess in one of the roots of a maxillary posterior tooth, maxillary sinusitis can result as infection spreads (due to the proximity of the maxillary sinuses and the roots of the maxillary posterior teeth). Also due to the proximity, a patient may sometimes mistakenly misplace symptoms. For example, a patient may think there is a problem with a maxillary tooth,

whereas discomfort is coming from the sinuses but is presenting around the region of the tooth.

Sinusitis: inflamed mucosal tissue in the paranasal sinus

Clinical considerations for the dental professional include:

- Inability to use nitrous oxide adequately
- Lack of comfort while using a rubber dam
- Mouth breathing, which is a risk factor for chronic gingivitis of the maxillary anterior teeth
- During an extraction, a contaminated tooth or root fragment may be surgically displaced in the maxillary sinus

Slides 53-58: Anatomical Landmarks Seen Radiographically

The maxillary sinus sometimes appears as overlapping lobes or a single radiolucent area with a radiopaque border. The incisive foramen is seen as a dark area located between and extending above the central incisors.

The median palatal suture appears as a radiolucent line extending posteriorly from the alveolar border in the sagittal plane of the maxilla. The paired nasal fossae appear as somewhat elliptical radiolucent areas of various sizes separated by a radiopaque band representing the nasal septum. The nasal septum is usually seen as a white ridge extending above and between the central incisors. The nasal septum is also present in the image in slide 54.

The maxillary tuberosity is the convex distal inferior border of the maxilla, curving upward from the alveolar process and distal of the third molar. The coronoid process of the mandible may appear on maxillary molar images as a triangular opaque area located in the region of or distal to the maxillary tuberosity projecting posteriorly.

The zygomatic arch commonly appears as a well-defined radiopaque area that may be superimposed over the molar roots. The external oblique ridge is a white line of variable density extending into the

molar region as a continuation of the anterior border of the ramus of the mandible. The mylohyoid ridge is also seen in the left image on slide 56.

The mylohyoid ridge appears as a white line of varying width and in density extending from close to the lower border of the symphysis of the mandible, upward and distally, to end beyond the third molar. It is usually not a prominent feature.

The mandibular canal appears as a dark band with radiopaque borders, running downward and forward from the mandibular foramen in the ramus to the region of the bicuspid teeth in the body of the mandible. It may be seen below the roots of the posterior teeth. The mental foramen is seen as a dark area below and between the bicuspids.

See slide 58 for anatomical landmarks seen radiographically.

Slide 59: Dental Relation to the Muscular System

The craniofacial muscles are essential to chewing and making facial expressions. They control movement of the cheeks, chin, ears, eyebrows, eyelids, forehead, upper and lower lips, nose, and nostrils.

*Use the Sagittal Head Model for this part of the lesson involving muscular features

- Facial muscles are responsible for:
 - Mastication
 - Facial expression
 - Protection of the eyes
 - Ability to talk, sing, whistle, etc.
- They are categorized by general location:
 - **Buccolabial:** muscles in and around the mouth
 - **Nasal:** muscles around the nose
 - **Epicranial:** muscles of the forehead, skull, and neck
 - **Auricular:** muscles around the ears
 - **Orbital:** muscles surrounding the eyes

Slide 60: Muscles of Mastication

These are the muscles involved in chewing.

- **Buccinator:** thin muscle in the cheek that holds each cheek toward the teeth
- **Lateral pterygoid:** a fan-shaped muscle that assists in opening the jaw
- **Masseter:** powerful bilateral muscle that runs from each cheek to each side of the jaw and assists with closing the jaw
- **Medial pterygoid:** a thick muscle that helps close the jaw
- **Temporalis:** a fan-shaped muscle that helps close the jaw

Slide 61: Muscles of Facial Expression

These are the muscles involved in facial expression.

- **Auriculars:** allow movement of ears
- **Corrugator supercilii:** Enables frowning, located near the eyebrow
- **Depressor anguli oris:** assists in frowning, located on each side of the chin
- **Depressor labii inferioris:** helps control movement in lower lip, located in chin
- **Levator labii superioris alaeque nasi:** opens nostrils and lifts upper lip
- **Mentalis:** pair of muscles toward the center of the chin that help control the lower lip
- **Nasalis:** allows flaring of nostrils
- **Occipitofrontalis:** muscle extending from the eyebrows to the top of the skull, enabling one to raise eyebrows and wrinkle the forehead
- **Orbicularis oculi:** enables closing of eyelids
- **Orbicularis oris:** circle of muscle around the mouth that closes or purses the lips
- **Procerus:** muscle located between the eyebrows that enables the eyebrows to be pulled downward and assists in flaring the nostrils
- **Risorius:** aids in smiling, located on each side of the mouth

- **Zygomaticus major and minor:** enables smiling

Slide 62: Clinical Considerations for the Muscles of the Face

To function, facial muscles receive signals from the brain via facial nerves. When facial muscles cannot receive brain signals properly, it may cause drooping or sagging, facial palsy (weakness), facial paralysis (inability to move parts of the face), difficulty chewing, speaking or making facial expressions, and drooling.

Bell's palsy causes facial weakness or paralysis on one or both sides of the face due to pressure on the facial nerve from swelling. Symptoms happen suddenly but are usually temporary. It most commonly leads to a complete inability to wrinkle the forehead. A growing tumor can interfere with facial muscle function over time. A bacterial or viral infection can cause inflammation of the facial nerve and problems in the muscles of the face such as ear infections, Lyme disease, or Ramsay Hunt syndrome.

Facial trauma can damage the facial nerve and facial muscles. A [stroke](#) occurs when a blood vessel in the brain is blocked or bursts. It can cause sudden facial weakness or paralysis. Other signs may include paralysis on one side of the body, confusion, memory loss, and trouble communicating. A person who has had a stroke can usually still wrinkle the forehead, unlike with Bell's palsy.

Facial palsy: weakness

Facial paralysis: inability to move parts of the face

Symptoms may occur:

- All over the face
- In one specific area
- On either the left or right side of the face
- The top or bottom half of the face

Conditions associated with nerve damage and/or problems with usage of facial muscles include:

- Autoimmune diseases, such as Guillain-Barre syndrome or multiple sclerosis
- Bell's palsy
- Head and neck cancer
- Infection
- Injury to the head or face
- Stroke

Slide 63: Dental Relation to the Skeletal System

The skull supports the face and forms a protective cavity for the brain. The skull is formed by intramembranous ossification and joined by sutures that are called fibrous joints. All bones are joined together except for the mandible. Bones in the cranial base articulate with the 1st cervical vertebra (atlas), the mandible, and the facial bones. The occipital bone forms the atlantooccipital joint with the atlas. The frontal, ethmoid, and sphenoid bones contain the paranasal sinuses.

*Use the Human Skull Model for this part of the lesson involving skeletal features

The skull is made up of 22 bones: 8 cranial bones and 14 facial skeletal bones. The skull supports the face and forms a protective cavity for the brain.

- **Cranium (aka neurocranium):** formed by the superior aspect of the skull; encloses and protects the brain, cerebral vasculature, and meninges
 - Divided into cranial base and cranial roof
 - Cranial bones: Ethmoid, frontal, occipital, parietal (2), sphenoid, temporal (2)
- **Cranial roof (aka the calvarium):** composed of the frontal, occipital, and two parietal bones
 - The occipital bone contains the foramen magnum
- **Foramen magnum:** opening through which the spinal cord enters the skull to attach to the brain
- **Cranial base:** comprised of frontal, sphenoid, parietal, occipital, ethmoid, and temporal bones

Slide 64: The Facial Skeleton

The orbits of the eyes, the nasal and oral cavities, and the sinuses are all fused together by 14 bones.

- **Facial skeleton (aka viscerocranium):** supports the soft tissues of the face
- **Facial skeletal bones:** inferior nasal concha (2), lacrimal (2), mandible, maxilla (2), nasal (2), palatine (2), vomer, zygomatic (2)
- **Zygomatic:** bone that forms the cheekbones of the face and articulates with the frontal, sphenoid, temporal, and maxilla bones
- **Lacrimal:** the smallest bones of the face which form part of the medial wall of the orbit
- **Nasal:** the two slender bones that are located at the bridge of the nose
- **Inferior nasal conchae:** located within the nasal cavity, increases the surface area of the nasal cavity, and thus helps in increasing the amount of air that meets the cavity walls
- **Palatine:** forms part of the hard palate, situated at the rear of the oral cavity
- **Maxilla:** comprises part of the upper jaw and hard palate
- **Vomer:** forms the posterior aspect of the nasal septum
- **Mandible:** articulates with the base of the cranium at the temporomandibular joint (TMJ)
- **Bones of the ear:** incus (2), malleus (2), and stapes (2)

Slide 65: Sutures

Fusion of the skull bones finishes at the age of 20. These joint suture areas represent points of potential weakness and are important in the context of trauma.

- **Sutures:** a form of immovable fibrous joint found only in the skull that fuses adjacent bones together

- Main sutures in the adult skull include the coronal suture, sagittal suture, and lambdoid suture
- **Coronal suture:** fuses the frontal bone with the two parietal bones
- **Sagittal suture:** fuses both parietal bones to each other
- **Lambdoid suture:** fuses the occipital bone to the two parietal bones

Slide 66: Fractures

Fractures of the cranium arise from penetrating trauma or blunt force.

- **Nasal fracture:** most common facial fracture
- **Maxillary fracture:** associated with high-energy trauma; classified using the Le Fort classification system, ranging from 1-3
- **Mandibular fracture:** often bilateral, occurring indirectly at the contralateral side due to transmitted forces and directly at the site of trauma
- **Zygomatic arch fracture:** linked with trauma to the side of the face
- **Pterion:** H-shaped junction between the frontal, temporal, parietal, and sphenoid bones; overlies the middle meningeal artery, which can be injured by fractures in this location; can result in an extradural hematoma

Slide 67: Fontanelles

- **Fontanelles:** membrane spaces between bones that form in newborns due to incompletely fused suture joints
 - The two primary fontanelles are the frontal fontanelle and occipital fontanelle
- **Frontal fontanelle:** located at the junction of the sagittal sutures and coronal
- **Occipital fontanelle:** located at the junction of the lambdoid sutures and sagittal

Slides 68-74: Foramens, Fissures, and Associated Structures

Foramina are holes in the skull that serve as passageways through the bones of the skull that allow different structures of the nervous and circulatory system to enter and exit the skull. A fissure also allows passage of cranial nerves into or out of the skull. The anterior cranial fossa contains the foramen cecum and olfactory foramina in the cribriform plate.

The foramen cecum is the most anterior of the holes in the floor of the skull. It lies in the frontal bone, just anterior to the ethmoid bone.

- **Foramen (foramina, plural):** an opening, hole, or passage in a bone
- **Fissure:** a natural cleft creating a passageway through bone

The floor or base of the skull can be divided into three different shallow depressions known as fossae: anterior, middle, and posterior

- **Fossae:** shallow, wide depressions
- **Anterior cranial fossa:** comprised of frontal, ethmoid, and sphenoid bones
- **Foramen cecum:** allows the passage of the emissary vein that comes from the nasal cavity and drains into the superior sagittal sinus (part of the venous drainage system associated with the brain)

Nerve endings pass through the olfactory foramina in the ethmoid bone and then combine within the cranial cavity on top of the cribriform plate to form the olfactory bulb. The olfactory tract then relays the information to the brain.

Most foramina are in the middle cranial fossa, which include the: optic canal, superior orbital fissure, foramen rotundum, foramen ovale, foramen spinosum, foramen lacerum, and the carotid canal.

The optic canal lies within the lesser wing of the sphenoid just anterior and medial to the anterior clinoid process of the sphenoid bone.

- **Emissary veins:** veins that drain blood from outside the cranial cavity to inside the cranial cavity via foramina in the skull
- **Olfactory foramina in the cribriform plate:** comprise a pathway of the first cranial nerve (CNI), the olfactory nerve, to allow for smell receptors to travel to the brain
- **Middle cranial fossa:** comprised of sphenoid, temporal, and parietal bones
- **Optic canal:** allows passage of ophthalmic artery and the second cranial nerve (CNII), the optic nerve, to travel to and from the eye
- **Ophthalmic artery:** supplies blood to the retina of the eye
- **Optic nerve (the second cranial nerve):** sends visual information from the eye to the brain for interpretation; contains a dural sheath

The superior orbital fissure is located between the lesser and greater wings of the sphenoid, just posterior and lateral to the optic canal at the back of the eye orbit (socket). It allows passageway to and from the orbit, allowing important structures to pass to and from the eye such as the third cranial nerve (CNIII) the oculomotor nerve, the fourth cranial nerve (CNIV) the trochlear nerve, and the sixth cranial nerve (CNVI) the abducent nerve.

The fifth cranial nerve (CNV) the trigeminal nerve (specifically the first division, aka CNV1) also passes through on its way through the orbit carrying sensory information from the forehead and parts of the face near the eyes.

- **Superior orbital fissure:** allows passageway to and from the orbit, allowing important structures to pass to and from the eye:
 - The oculomotor nerve
 - The trochlear nerve
 - The abducent nerve
 - The trigeminal nerve
 - Ophthalmic veins

- **Oculomotor nerve (CNIII, the third cranial nerve):** provides nervous input to four out of the six muscles that move the eyeball
- **Trochlear nerve (CNIV, the fourth cranial nerve):** provides nervous input to the other two muscles that move the eyeball
- **Abducent nerve (CNVI, the sixth cranial nerve):** also provides nervous input to the other two muscles that move the eyeball

The foramen rotundum is a small, round hole lying posterior to the optic canal and the superior orbital fissure. The foramen ovale is an oval-shaped hole lying posterior and lateral to the foramen rotundum. The mandibular nerve enters the skull through the foramen ovale bringing sensory information from the face and skin that overlies the mandible.

It occasionally also allows passage of the ninth cranial nerve (CNIX), the glossopharyngeal nerve, which innervates the parotid gland. The foramen spinosum is the smallest and most lateral foramen; located posterior and lateral to the foramen ovale. The foramen lacerum is located posterior and medial to the foramen ovale. It may be filled with cartilage.

- **Foramen rotundum:** allows the maxillary nerve to enter the skull, carrying sensory information coming from areas of the face associated with the region under the eyes, the upper lip, and the skin overlying the maxilla bone
- **Foramen ovale:** allows passage of the mandibular nerve
- **Foramen spinosum:** allows the middle meningeal artery to enter the skull supplying blood to the dura mater that surrounds the brain
- **Foramen lacerum:** allows passage of the facial nerve providing innervation to the glands located about the level of the mouth

The carotid canal lies immediately posterior and lateral to the foramen lacerum. The posterior cranial fossa is comprised mostly of occipital and temporal

bones (and to a lesser extent, the sphenoid and parietal bones as well).

The internal acoustic meatus is the most anterior hole in the posterior cranial fossa. The two cranial nerves that enter the skull through the internal acoustic meatus are the seventh/facial nerve and the eighth (CNVIII), the vestibulocochlear nerve.

The jugular foramen is more consistent in appearance to a fissure than a foramen.

- **Carotid canal:** allows the internal carotid artery to enter the skull
- **Internal carotid artery:** one of the major blood supplies to the brain; also supplies blood to the eye, the contents of the orbit, and the forehead
- **Posterior cranial fossa:** contains the internal acoustic meatus, jugular foramen, hypoglossal canal, and the foramen magnum
- **Internal acoustic meatus:** one end of the passageway that houses hearing and balance apparatus (other end is the external acoustic meatus aka the outer hole of the ear)
- **Facial nerve (CNVII, the seventh cranial nerve):** has a wide range of functions, including providing nervous input to the muscles of facial expression and taste sensation from the tongue
- **Vestibulocochlear nerve (CNVIII, the eighth cranial nerve):** brings sensory information from the cochlea (part of the hearing apparatus) and from the vestibular canal system contained within the ear
- **Jugular foramen:** allows passage for the glossopharyngeal, vagus, and spinal accessory cranial nerves

The spinal accessory nerve arises from the upper segments of the cervical portion of the spinal cord, ascends into the skull via the foramen magnum and then back out through the jugular foramen supplying the sternocleidomastoid and trapezius muscles in the neck.

The hypoglossal canal is closest to the foramen magnum. Arteries travel up each side of the spinal column and enter the skull through the foramen magnum to provide another important supply of blood to the brain.

- **Glossopharyngeal nerve (CNIX, the ninth cranial nerve):** innervates the tongue and pharynx structures
- **Vagus nerve (CNX, the tenth cranial nerve):** innervates many of the abdominal cavity organs
- **Spinal accessory nerve (CNXI, the eleventh cranial nerve):** supplies the sternocleidomastoid and trapezius muscles in the neck
- **Internal jugular vein:** drains much of the blood from the head and parts of the neck down into the brachiocephalic vein and to the heart via the superior vena cava
- **Hypoglossal canal:** allows passage of the hypoglossal nerve
- **Hypoglossal nerve (CNXII, the twelfth cranial nerve):** provides innervation to all but one of the muscles of the tongue
- **Foramen magnum:** allows the lower end of the brainstem and upper end of the spinal cord to pass through and vertebral arteries to enter the skull

Slide 75: Dental Relation to the Nervous System

Twelve pairs of cranial nerves arise in the brain and give off branches to the structures of the head and face. These nerves leave the cranial cavity through foramina in the base of the cranium. The trigeminal nerve is the largest of the twelve pairs. It is of particular importance in dentistry since it provides the nerve supply to the jaws and the teeth.

The nerves supplying the teeth also accompany the arteries through the root canals and originate from the [maxillary](#) and [mandibular](#) branches of the [trigeminal](#), or fifth, [cranial nerve](#). The sensory root of the trigeminal nerve divides into three branches or divisions: the ophthalmic nerve (first division), the maxillary nerve (second division), and the mandibular nerve (third division).

- 12 pairs of cranial nerves arise in the brain
- Nerves give off branches to the head and face structures
- Nerves leave the cranial cavity through foramina
- The trigeminal nerve is the largest
 - Significant importance in dentistry
 - Provides the nerve supply to the jaws and the teeth
 - Has both sensory and motor functions
 - Can impact on other cranial nerves
 - Has a motor root supplying motor impulses to the muscles of mastication
 - Has a sensory root supplying sensory impulses from the structures of the head and face
- Near the teeth, these major nerves give rise to the following branches:
 - Superior alveolar nerves
 - Inferior alveolar nerves

Slide 76: Divisions of the Trigeminal Nerve

The maxillary nerve does not contain somatic motor fibers. To innervate the maxillary teeth, the maxillary nerve on each side passes forward in the floor of the orbit of the eye. It first gives off the posterior superior alveolar branch to the three maxillary molars. When in the floor, the maxillary nerve gives off a middle superior alveolar branch to the maxillary bicusps and mesial root of the first molar. Then, the maxillary nerve gives off an anterior superior alveolar branch to the maxillary incisors and cuspid. The maxillary nerve on each side also gives off a palatine nerve, which has an anterior, middle, and posterior branch, innervating the palatal area.

The anterior palatine nerve emerges upon the hard palate through the greater palatine foramen and passes forward nearly to the incisor teeth where it ends with fibers of the nasopalatine nerve. It supplies the gingiva, the mucous membrane, and the glands of the hard palate and part of the soft palate. The middle and posterior palatine nerves reach the soft palate area through the lesser palatine

foramina and give off branches to the uvula, tonsil, and soft palate.

Another branch of the maxillary nerve gives rise to the nasopalatine nerve. This nerve descends to the roof of the mouth through the incisive canal and communicates with the corresponding nerve of the opposite side and with the anterior palatine nerve.

The mandibular nerve contains somatic motor fibers as well as sensory nerve fibers (the first two divisions are primarily sensory). This nerve passes downward to enter the mandible through the mandibular foramen. Before entering the foramen, it gives off branches to the mastication muscles and a large sensory branch to the tongue. Thus, it provides motor impulses for mastication and general sensation to the anterior two thirds of the tongue, the mandible and the mandibular teeth, the soft tissues of the tongue, the soft tissues of the floor of the mouth, and the soft tissues surrounding the teeth.

The sensory root of the trigeminal nerve divides into three branches or divisions: ophthalmic nerve (first division), maxillary nerve (second division), and mandibular nerve (third division):

- **Ophthalmic nerve (first division):**
Supplies sensation to the eyes, the tear-producing glands, the mucous lining of the nose, the eyelids, the eyebrows, and the forehead
- **Maxillary nerve (second division):**
Supplies sensation to the central part of the face, including the maxillary bone, all the maxillary teeth, the soft tissues of the hard palate, and the soft tissues surrounding the teeth
- **Mandibular nerve (third division):**
Supplies sensation to the mandible and the teeth; provides motor impulses for mastication and general sensation to the anterior two thirds of the tongue, the mandible and the mandibular teeth, the soft tissues of the tongue, the soft tissues of the floor of the mouth, and the soft tissues surrounding the teeth

Slides 77-78: Dental Relation to the Circulatory System

The blood supply of the teeth originates from the maxillary artery, which is the largest terminal branch of the external carotid artery. It is responsible for supplying the deep structures of the face. The specific arteries carrying blood to the teeth travel through the root canals of the teeth. The veins of the teeth follow the arteries, having similar names. They drain into the pterygoid plexus or the facial vein. The major veins from the brain and the facial structures join the internal jugular vein.

The blood supply of the teeth originates from the maxillary artery. Specific arteries carrying blood to the teeth:

- Anterior superior alveolar arteries
- Posterior superior alveolar arteries
- Inferior alveolar arteries
 - Permanent maxillary anterior teeth are supplied by the anterior superior alveolar artery
 - Permanent maxillary posterior teeth are supplied by the posterior superior alveolar artery
 - All permanent mandibular teeth (both anterior and posterior) are supplied by branches of the inferior alveolar artery

Veins of the teeth drain into the pterygoid plexus/facial vein.

- Maxillary teeth are drained by the posterior superior alveolar vein
- Mandibular teeth are drained by the inferior alveolar vein

The principal arteries supplying the head and the neck are the common carotid arteries. These arteries ascend within the tissues of the neck, one on the right side and one on the left side. At the level of the hyoid bone, each common artery divides into an internal carotid and an external carotid. The external carotid has eight branches. Just above its division from the common carotid, the external

carotid gives off the lingual artery. Just above the origin of the lingual artery, the external carotid gives off another branch, the facial artery. At the level of the lower part of the ear, the external carotid divides into two main terminal branches: the maxillary artery and the superficial temporal artery.

- **Arterial blood:** Carries blood from the heart to the tissues of the body
- **Internal carotid:** Supplies the tissues of the cranium and the eyes
- **External carotid:** Supplies the exterior of the head, face, and much of the neck
- **Lingual artery:** Supplies the tongue
- **Facial artery:** Supplies the soft tissues of the side of the face
- **Maxillary artery:** Supplies the bones of the jaws, the teeth, and their supporting tissues
- **Venous blood:** Carries blood from the tissues of the body back to the heart
- **Cavernous sinus:** Large channel of venous blood creating a "sinus" cavity bordered by the sphenoid bone and the temporal bone of the skull

Slide 79: Clinical Considerations for Veins

Some veins of the face, particularly in the upper lip and the nose area, are directly joined to the cavernous sinus. This venous drainage pattern is of particular importance since, unlike veins in other parts of the body, the veins of the face do not contain valves. Caution should be used to avoid needless aggravation of infected tissue in these areas. An infection in the facial area, to include the maxillary anterior teeth, can travel upward and rearward into the cavernous sinus. This may cause cavernous sinus thrombosis or clotting of blood in that area. Stopping the blood flow in the cavernous sinus would then cut off the flow to other parts of the brain, therefore, any infection in the upper teeth or facial area needs to be treated by the dental officer immediately.

Excessive irritation or aggravation of infected tissues, whose venous drainage is connected to the cavernous sinus, may result in a spread of infection to the cavernous sinus and then to the brain.

- Avoid needless aggravation of infected tissue in these areas
- An infection in the facial area can spread to the cavernous sinus
- May cause cavernous sinus thrombosis or clotting of the blood in that area
- **Treat immediately** to avoid cutting off the flow to other parts of the brain

Name: _____

Class: _____

Dental Anatomy Presentation Guide

Directions: Complete the following information as you listen to the Lesson 1 slide presentation.

Regions of the Face and Neck

The regions of the face include the: **frontal** region, **orbital** region, **nasal** region, **infraorbital** region, **zygomatic** region, **buccal** region, **oral** region, and **mental** region. The region of face that includes the forehead and area above the eyes is the _____ region. The region of the face that includes the bony orbit and eyeball is the _____ region. The region of the face occupied by the external nose is the _____ region. The region of the face located both inferior to the orbital region and lateral to the nasal region is the _____ region. The region of the face that overlies the zygomatic arch is the _____ region. The region of the face that includes the inner cheek is the _____ region. The region of face with the chin as the major feature is the _____ region.

The major joint located in the zygomatic region that controls the movements of the jaw is called the _____ joint or TMJ.

The powerful bilateral muscle of mastication located in the buccal region is the _____ muscle.

The oral region consists of the _____ and the _____.

The regions of the neck extend from the skull and lower jaw down to the _____ and _____.

The major strap muscle of the neck is called the _____ or SCM.

The Oral Cavity

Structures closest to the facial surface: _____

Structures closest to the lips: _____

Structures closest to the cheeks: _____

Structures closest to the tongue: _____

Structures closest to the palate: _____

Different types of mucosae found within the oral cavity:

1. Oral mucosa
2. _____ mucosa
3. Buccal mucosa
4. _____ mucosa

The maxilla consists of one / two (circle one) bone(s).

It is movable / non-movable (circle one).

The mandible consists of one / two (circle one) bone(s).

It is movable / non-movable (circle one).

Anatomy of a Tooth

Crown:

Part of tooth composed of dentin and pulp covered by _____

Root:

Part of a tooth composed of dentin covered by _____

Enamel:

Extremely hard _____ layer of tooth crown

Dentin:

Moderately hard inner layer of tooth crown overlying _____

Pulp:

Soft _____ connective tissue in both crown and root

Cementum:

Outermost layer of the root of a tooth

The part of the tooth that attaches to the _____, which then attaches to the alveolus of bone, holding the tooth in its socket

Primary Versus Permanent Teeth

Primary teeth include:

1. Incisors
2. Canines
3. Molars

Permanent teeth include:

1. Incisors

2. Canines
3. Molars
- AND
4. _____

Clinical Considerations of the Soft Tissue

Fordyce granules are small, yellowish elevations of sebaceous glands on oral mucosa.

- They are commonly found on _____ and _____ mucosa
- Spots represent deeper deposits of _____ from trapped or misplaced _____ gland tissue, usually associated with hair follicles
- Become more prominent with age due to the overlying tissue _____

Linea alba is a white ridge of keratinized epithelium (calloused tissue) that extends horizontally on buccal mucosa at the level where teeth occlude (come together).

- Commonly found on _____ mucosa
- Can sometimes be present on tongue perimeter as well
- Excess can be associated with certain oral parafunctional habits such as _____ (clenching, grinding, etc.)

Anatomy of the Palate

The firmer anterior part of the palate: _____

The looser posterior part of the palate: _____

Anatomy of the Tongue

The most posterior part of tongue is the: _____

The anterior part of the tongue is the: _____

The tip of the tongue is the: _____

The top surface of the tongue is the: _____

Lingual papillae

Papillae that are reddish, smaller, mushroom-shaped, and located on the dorsal surface of the tongue:

Filiform / Fungiform / Circumvallate / Foliate (Circle One)

Papillae found on the lateral surface of the tongue:

Filiform / Fungiform / Circumvallate / Foliate (Circle One)

Papillae that are larger and mushroom-shaped near the sulcus terminalis:

Filiform / Fungiform / Circumvallate / Foliate (Circle One)

Papillae that give the dorsal surface of the tongue its velvety texture:

Filiform / Fungiform / Circumvallate / Foliate (Circle One)

Floor of the Mouth

The submandibular duct is also known as the _____ duct.

The sublingual duct is also known as the _____ duct.

Pharyngeal Divisions

The pharyngeal divisions include the nasopharynx, oropharynx, and laryngopharynx.

- The division of the pharynx superior to the level of the soft palate, continuous with the nasal cavity is the: _____
- The oral division of the pharynx, between the soft palate and the opening of the larynx is the: _____
- The most inferior part of pharynx close to laryngeal opening is the _____

Glands

A gland is:

_____.

Endocrine glands have / do not have (Circle One) a duct associated with them.

Exocrine glands have / do not have (Circle One) a duct associated with them.

Functions of Saliva

1. Serves as _____ to protect from dryness
2. Cleanses the oral mucosa to protect from potential carcinogens by way of its mucins and other glycoproteins
3. Aids in food _____
4. Serves as a _____ providing protection of oral mucosa against acids from food products and dental biofilm and then later the stomach lining
5. Involved in antibacterial activity through its lysozyme content as well as secretory IgA; the glycoprotein of lactoferrin content inhibits growth of bacteria
6. Helps maintain tooth integrity (involved in the post eruptive maturation of enamel)
7. Helps with _____ of tooth surface because it is supersaturated with calcium and phosphate ions

Major Salivary Glands

There are three large, paired glands that have named associated ducts: the parotid, the submandibular, and the sublingual glands.

The largest of the three glands is the _____

The only gland without a capsule is the _____

The gland that provides the most salivary volume is the _____

The term used for dry mouth is: hyposalivation / xerostomia (Circle One)

Thyroid Gland Properties

- Ductless
- Produces and secretes its own products and hormones directly into the blood
- The hormone from the thyroid gland that stimulates the metabolic rate is: _____

Lymph Properties

Lymph refers to tissue fluid that drains from surrounding region into lymphatic vessels. Lymph nodes are bean-shaped filtering bodies grouped in clusters along connecting lymphatic vessels.

What is lymphadenopathy?

Paranasal Sinuses

Paranasal sinuses are:

They include the frontal, sphenoidal, ethmoidal, and maxillary sinuses.

They serve to _____ the skull bones, act as sound resonators, and provide _____ for the nasal cavity.

Dental Relation to the Muscular System

The craniofacial muscles are essential to chewing and making facial expressions. They control movement of the cheeks, chin, ears, eyebrows, eyelids, forehead, upper and lower lips, nose, and nostrils.

Facial muscles are responsible for:

- 1.) _____
- 2.) Facial expression
- 3.) _____ of the eyes
- 4.) Ability to talk, sing, whistle, etc.

The muscles of mastication include the: buccinator, lateral pterygoid, _____, medial pterygoid, and _____.

Facial palsy involves weakness of the face. Facial paralysis is the inability to move parts of the face.

Symptoms may occur all over the face, in one specific area, on either the left or right side of the face, on either the top or bottom half of the face. Conditions associated with nerve damage and/or problems with facial muscle usage include:

- Autoimmune diseases such as Guillain-Barre syndrome or multiple sclerosis
- _____ palsy
- Head and neck cancer
- _____
- Injury to the head or face
- _____

The Facial Skeleton

The facial skeleton (aka viscerocranium): Supports the soft tissues of the face. The facial skeletal bones include **inferior nasal concha (2)**, **lacrimal (2)**, **mandible**, **maxilla (2)**, **nasal (2)**, **palatine (2)**, **vomer**, and **zygomatic (2)** bones.

The bone that forms the cheekbones of the face: _____

The smallest bones of the face which form part of the medial wall of the orbit: _____

The two slender bones that are located at the bridge of the nose: _____

The bones located within the nasal cavity that help to increase the amount of air that meets the cavity walls: _____ nasal conchae

The bones that form part of the hard palate, situated at the rear of the oral cavity: _____

The bones that comprise part of the upper jaw and hard palate: _____

The bones that form the posterior aspect of the nasal septum: _____

The bone that articulates with the base of the cranium at the temporomandibular joint (TMJ): _____

Suture

A suture is:

Fractures

The most common facial fracture: _____

A fracture associated with high-energy trauma: _____

A fracture that may occur indirectly at the contralateral side due to transmitted forces: _____

A fracture that is linked to trauma on the side of the face: _____

Foramens

Foramina are holes in the skull that serve as passageways through the bones of the skull that allow different structures of the nervous and circulatory system to enter and exit the skull. A fissure also allows passage of cranial nerves into or out of the skull. The foramen cecum is the most anterior of the holes in the floor of the skull. It lies in the frontal bone, just anterior to the ethmoid bone. Other major foramens include:

1. Foramen rotundum
2. _____
3. Foramen spinosum
4. _____

Cranial Nerves

The 12 cranial nerves:

I: The olfactory nerve

II: The optic nerve

III: The _____ nerve

IV: The trochlear nerve

V: The _____ nerve

VI: The abducent nerve

VII: The _____ nerve

VIII: The vestibulocochlear nerve

IX: The _____ nerve

X: The _____ nerve

XI: The spinal accessory nerve

XII: The _____ nerve

The **trigeminal nerve** is the largest nerve:

- It has significant importance in dentistry
- It provides the _____ supply to the jaws and the teeth
- It has both _____ and _____ functions
- It can impact on other cranial nerves
- It has a motor root supplying motor impulses to the muscles of mastication
- It has a sensory root supplying sensory impulses from the structures of the head and face
- It is divided into three divisions: _____, _____, and _____

Dental Anatomy Presentation Guide – Answer Key

Regions of the Face and Neck

The regions of the face include the: **frontal** region, **orbital** region, **nasal** region, **infraorbital** region, **zygomatic** region, **buccal** region, **oral** region, and **mental** region. The region of face that includes the forehead and area above the eyes is the **frontal** region. The region of the face that includes the bony orbit and eyeball is the **orbital** region. The region of the face occupied by the external nose is the **nasal** region. The region of the face located both inferior to the orbital region and lateral to the nasal region is the **infraorbital** region. The region of the face that overlies the zygomatic arch is the **zygomatic** region. The region of the face that includes the inner cheek is the **buccal** region. The region of face with the chin as the major feature is the **oral** region.

The major joint located in the zygomatic region that controls the movements of the jaw is called the **Temporomandibular** joint or TMJ.

The powerful bilateral muscle of mastication located in the buccal region is the **masseter** muscle.

The oral region consists of the **maxilla** and the **mandible**.

The regions of the neck extend from the skull and lower jaw down to the **clavicles** and **sternum**

The major strap muscle of the neck is called the **Sternocleidomastoid muscle** or SCM.

The Oral Cavity

Structures closest to the facial surface: **facial**

Structures closest to the lips: **labial**

Structures closest to the cheeks: **buccal**

Structures closest to the tongue: **lingual**

Structures closest to the palate: **palatal**

Different types of mucosae found within the oral cavity:

1. Oral mucosa
1. **Labial** mucosa
2. Buccal mucosa
3. **Alveolar** mucosa

Introduction to Dental Anatomy, Morphology, and Physiology Curriculum

The maxilla consists of **one** / two (circle one) bone(s).

It is movable / **non-movable** (circle one).

The mandible consists of one / **two** (circle one) bone(s).

It is **movable** / non-movable (circle one).

Anatomy of a Tooth

Crown:

Part of tooth composed of dentin and pulp covered by **enamel**

Root:

Part of a tooth composed of dentin covered by **cementum**

Enamel:

Extremely hard **outer** layer of tooth crown

Dentin:

Moderately hard inner layer of tooth crown overlying **pulp**

Pulp:

Soft **innermost** connective tissue in both crown and root

Cementum:

Outermost layer of the root of a tooth

The part of the tooth that attaches to the **PDL** which then attaches to the alveolus of bone, holding the tooth in its socket

Primary Versus Permanent Teeth

Primary teeth include:

1. Incisors
2. Canines
3. Molars

Permanent teeth include:

1. Incisors
2. Canines
3. Molars

AND

4. **Premolars**

Clinical Considerations of the Soft Tissue

Fordyce granules are small, yellowish elevations of sebaceous glands on oral mucosa.

- They are commonly found on **labial** and **buccal** mucosa
- Spots represent deeper deposits of **sebum** from trapped or misplaced **sebaceous** gland tissue, usually associated with hair follicles
- Become more prominent with age due to **thinning** of the overlying tissue

Linea alba is a white ridge of keratinized epithelium (calloused tissue) that extends horizontally on buccal mucosa at the level where teeth occlude (come together).

- Commonly found on **buccal** mucosa
- Can sometimes be present on tongue perimeter as well
- Excess can be associated with certain oral parafunctional habits such as **bruxism** (clenching, grinding, etc.)

Anatomy of the Hard Palate

The firmer anterior part of the palate: **hard palate**

The looser posterior part of the palate: **soft palate**

Anatomy of the Tongue

The most posterior part of tongue is the: **base**

The anterior part of the tongue is the: **body**

The tip of the tongue is the: **apex**

The top surface of the tongue is the: **dorsal surface**

Lingual papillae

Papillae that are reddish, smaller, mushroom-shaped, and located on the dorsal surface of the tongue:

Filiform / **Fungiform** / Circumvallate / Foliate (Circle One)

Papillae found on the lateral surface of the tongue:

Filiform / Fungiform / Circumvallate / **Foliate** (Circle One)

Papillae that are larger and mushroom-shaped near the sulcus terminalis:

Filiform / Fungiform / **Circumvallate** / Foliate (Circle One)

Papillae that give the dorsal surface of the tongue its velvety texture:

Filiform / Fungiform / Circumvallate / Foliate (Circle One)

Floor of the Mouth

The submandibular duct is also known as the **Wharton** duct.

The sublingual duct is also known as the **Bartholin** duct.

Pharyngeal Divisions

The pharyngeal divisions include the: nasopharynx, oropharynx, and laryngopharynx.

- The division of the pharynx superior to level of soft palate, continuous with the nasal cavity is the: **Nasopharynx**
- The oral division of the pharynx, between the soft palate and the opening of the larynx is the: **Oropharynx**
- The most inferior part of pharynx close to laryngeal opening is the **Laryngopharynx**

Glands

A gland is:

a structure that produces a secretion necessary for normal body functioning

Endocrine glands have / **do not have** (Circle One) a duct associated with them.

Exocrine glands **have** / do not have (Circle One) a duct associated with them.

Functions of Saliva

1. Serves as **lubrication** to protect from dryness
2. Cleanses the oral mucosa to protect from potential carcinogens by way of its mucins and other glycoproteins
3. Aids in food **digestion**
4. Serves as a **buffer** providing protection of oral mucosa against acids from food products and dental biofilm and then later the stomach lining

5. Involved in antibacterial activity through its lysozyme content as well as secretory IgA; the glycoprotein of lactoferrin content inhibits growth of bacteria
6. Helps maintain tooth integrity (involved in the post eruptive maturation of enamel)
7. Helps with **remineralization** of tooth surface because it is supersaturated with calcium and phosphate ions

Major Salivary Glands

There are three large, paired glands that have named associated ducts: the parotid, the submandibular, and the sublingual glands.

The largest of the three glands is the **Parotid**

The only gland without a capsule is the **Sublingual**

The gland that provides the most salivary volume is the **Submandibular**

The term used for dry mouth is: hyposalivation / **xerostomia** (Circle One)

Thyroid Gland Properties

- Ductless
- Produces and secretes its own products and hormones directly into the blood
- The hormone from the thyroid gland that stimulates the metabolic rate is: **thyroxine**

Lymph Properties

Lymph refers to tissue fluid that drains from surrounding region into lymphatic vessels. Lymph nodes are bean-shaped filtering bodies grouped in clusters along connecting lymphatic vessels.

What is lymphadenopathy?

Lymphadenopathy is enlarged and palpable lymph nodes; results due to an increase in the size of each individual lymphocyte as well as the overall cell count in the lymphoid tissue.

Paranasal Sinuses

Paranasal sinuses are:

paired air-filled cavities in bone

They include the frontal, sphenoidal, ethmoidal, and maxillary sinuses.

They serve to **lighten** the skull bones, act as sound resonators, and provide **mucus** for the nasal cavity.

Dental Relation to the Muscular System

The craniofacial muscles are essential to chewing and making facial expressions. They control movement of the cheeks, chin, ears, eyebrows, eyelids, forehead, upper and lower lips, nose, and nostrils.

Facial muscles are responsible for:

- 1.) **Mastication**
- 2.) Facial expression
- 3.) **Protection of the eyes**
- 4.) Ability to talk, sing, whistle, etc.

The muscles of mastication include the: buccinator, lateral pterygoid, **temporalis**, medial pterygoid, and **masseter**.

Facial palsy involves weakness of the face. Facial paralysis is the inability to move parts of the face. Symptoms may occur all over the face, in one specific area, on either the left or right side of the face, on either the top or bottom half of the face. Conditions associated with nerve damage and/or problems with usage of facial muscles include:

- Autoimmune diseases such as Guillain-Barre syndrome or multiple sclerosis
- **Bell's palsy**
- Head and neck cancer
- **Infection**
- Injury to the head or face
- **Stroke**

The Facial Skeleton

The facial skeleton: (aka viscerocranium) supports the soft tissues of the face. The facial skeletal bones include **inferior nasal concha** (2), **lacrimal** (2), **mandible**, **maxilla** (2), **nasal** (2), **palatine** (2), **vomer**, and **zygomatic** (2) bones.

The bone that forms the cheekbones of the face: **Zygomatic**

The smallest bones of the face which form part of the medial wall of the orbit: **Lacrimal**

The two slender bones that are located at the bridge of the nose: **Nasal**

The bones located within the nasal cavity that help to increase the amount of air that meets the cavity walls: **Inferior nasal conchae**

The bones that form part of the hard palate, situated at the rear of the oral cavity: **Palatine**

The bones that comprise part of the upper jaw and hard palate: **Maxilla**

The bones that form the posterior aspect of the nasal septum: **Vomer**

The bone that articulates with the base of the cranium at the temporomandibular joint (TMJ): **Mandible**

Suture

A suture is

a form of immovable fibrous joint found only in the skull that fuses adjacent bones together

Fractures

The most common facial fracture: **Nasal fracture**

A fracture associated with high energy trauma: **Maxillary fracture**

A fracture that may occur indirectly at the contralateral side due to transmitted forces:

Mandibular fracture

A fracture that is linked to trauma on the side of the face: **Zygomatic arch fracture**

Foramens

Foramina are holes in the skull that serve as passageways through the bones of the skull that allow different structures of the nervous and circulatory system to enter and exit the skull. A fissure also allows passage of cranial nerves into or out of the skull. The foramen cecum is the most anterior of the holes in the floor of the skull. It lies in the frontal bone, just anterior to the ethmoid bone. Other major foramens include:

1. Foramen rotundum
2. **Foramen ovale**
3. Foramen spinosum
4. **Foramen lacerum**

Cranial Nerves

The 12 cranial nerves:

I: The olfactory nerve

II: The optic nerve

III: **The oculomotor nerve**

IV: The trochlear nerve

V: **The trigeminal nerve**

VI: The abducent nerve

VII: **The facial nerve**

VIII: The vestibulocochlear nerve

IX: **The glossopharyngeal nerve**

X: **The vagus nerve**

XI: The spinal accessory nerve

XII: **The hypoglossal nerve**

The **trigeminal nerve** is the largest nerve:

- It has significant importance in dentistry
- It provides the **nerve supply** to the jaws and the teeth
- It has both **sensory** and **motor** functions
- It can impact on other cranial nerves
- It has a motor root supplying motor impulses to the muscles of mastication
- It has a sensory root supplying sensory impulses from the structures of the head and face
- It is divided into three divisions: **ophthalmic**, **maxillary**, and **mandibular**.

Lesson One – Dental Anatomy

REVIEW: Identification and Assessment of Dental Anatomy and Physiology

20-30 minutes

Purpose:

Participants will apply the knowledge learned in the lecture. They will identify various anatomic structures on the provided models using the vocabulary flashcards.

Materials:

- Vocabulary flashcards
- Anatomical Models
- *Dental Anatomy Quiz*
- *Dental Anatomy Quiz – Answer Key*

Facilitation Steps:

1. Using their flashcards, have the participants review the vocabulary words.
2. Have participants get in a group and quiz each other on the structures/landmarks and their definitions.
3. To integrate the use of the Dental Anatomy Models, have the paired-up participants rotate around the tables where the models are set up in stations again like in the FOCUS section. This time they can use what they learned in the lesson to identify the different structures/landmarks on the models.
4. Organize the flashcards so that the correct ones are at each table to match each model. Have the paired-up participants point out each structure/landmark using the flashcards with the names listed.
5. Have participants mix the flashcards back up before they rotate to the next station. This gives each group a chance to correctly match the flashcards to the structures/landmarks on the models.
6. When participants are finished at each station, instruct them to take a few minutes to complete the quiz.
7. Have participants self-check their answers as you share from the answer key.

Station 1: Upper Jaw and Mandible Models

Station 2: Six Times Normal Tooth Anatomy Model

Station 3: Sagittal Head Model

Station 4: Oversize Tongue Model

Station 5: Human Skull Model

Name: _____ Class: _____

Dental Anatomy Quiz

Select the best answer to the following multiple-choice questions:

1. The following are all regions of the face, except:
 - a. Mental region
 - b. Labial region
 - c. Zygomatic region
 - d. Infraorbital region
2. True or False: The maxilla consists of two maxillary bones sutured together, has a movable articulation, and contains many facial and skull bones.
3. Where might you find most of the papillae on the tongue?
 - a. The ventral surface of the tongue
 - b. The lateral surface of the tongue
 - c. The dorsal surface of the tongue
4. True or False: The parotid is the largest salivary gland, and it provides most of the total salivary volume.
5. The following are all clinical considerations for the presence of sinusitis, except:
 - a. Heavy saliva production
 - b. Inability to use nitrous oxide adequately
 - c. Lack of comfort while using the rubber dam
 - d. Mouth breathing
6. Which of the following are muscles of mastication?
 - a. Buccinator
 - b. Lateral Pterygoid
 - c. Medial Pterygoid
 - d. Temporalis
 - e. All the above
7. Which nerve is the most significant to dentistry?
 - a. The abducent nerve
 - b. The hypoglossal nerve
 - c. The facial nerve
 - d. The trigeminal nerve
8. The blood supply of the teeth originates from the maxillary artery. Where do the veins of the teeth drain this blood into?
 - a. The lingual artery
 - b. The pterygoid plexus
 - c. The cavernous sinus
 - d. None of the above

Dental Anatomy Quiz – Answer Key

1. The following are all regions of the face, except:
 - a. Mental region
 - b. Labial region**
 - c. Zygomatic region
 - d. Infraorbital region
2. True or **False**: The maxilla consists of two maxillary bones sutured together, has a movable articulation, and contains many facial and skull bones.
3. Where might you find most of the papillae on the tongue?
 - a. The ventral surface of the tongue
 - b. The lateral surface of the tongue
 - c. The dorsal surface of the tongue**
4. True or **False**: The parotid is the largest salivary gland, and it provides most of the total salivary volume.
5. The following are all clinical considerations for the presence of sinusitis, except:
 - a. Heavy saliva production**
 - b. Inability to use nitrous oxide adequately
 - c. Lack of comfort while using the rubber dam
 - d. Mouth breathing
6. Which of the following are muscles of mastication?
 - a. Buccinator
 - b. Lateral Pterygoid
 - c. Medial Pterygoid
 - d. Temporalis
 - e. All the above**
7. Which nerve is the most significant to dentistry?
 - a. The abducent nerve
 - b. The hypoglossal nerve
 - c. The facial nerve
 - d. The trigeminal nerve**
8. The blood supply of the teeth originates from the maxillary artery. Where do the veins of the teeth drain this blood into?
 - a. The pterygoid plexus**
 - b. The lingual artery
 - c. The cavernous sinus
 - d. None of the above

Lesson Two – Dental Morphology

Lesson Overview

In this lesson, participants will learn to identify the various anatomical structures of the teeth and dentitions, recognize normal occlusion as well as malocclusions, and demonstrate the use of the differing numbering systems.

Lesson Objectives

After completing this lesson, participants will be able to:

- Demonstrate the use of the Universal and Palmer tooth numbering systems
- Identify structures of the teeth as well as primary and permanent dentitions
- Identify normal occlusion and the relationship between maxilla and mandible movement

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• Anatomical Models	1. Set out models for dental morphology content: Removable Child Dentition Model, Standard Tooth Model, Dentural Development Model 3-6 Years Old, Dentural Development Model 5-9 Years Old, Dentural Development Model 9-12 Years Old	10 minutes
LEARN	• <i>Dental Morphology</i> slide presentation • <i>Dental Morphology Presentation Guide</i> • <i>Dental Morphology Presentation Guide – Answer Key</i>	1. Prepare <i>Dental Morphology</i> slide presentation for viewing 2. Print the <i>Dental Morphology Presentation Guide</i> (one per participant)	45 minutes
REVIEW	• Vocabulary flashcards • Anatomical Models • <i>Dental Morphology Quiz</i> • <i>Dental Morphology Quiz – Answer Key</i>	1. Transfer the vocabulary list onto printable flashcards 2. Print vocabulary flashcards 3. Print the <i>Dental Morphology Quiz</i> (one per participant)	20-30 minutes

Instructor Note: Focus activities should tie into review. Have students examine models at the beginning of the lesson and then try to identify landmarks from the vocabulary flashcards on the models during the review.

Lesson Two – Dental Morphology

FOCUS: Getting Familiar with Anatomical Landmarks

10 minutes

Purpose:

Participants work in groups to examine the models used for this content, getting familiar with different landmarks and testing what they are already able to identify.

Materials:

- Removable Child Dentition Model
- Standard Tooth Model
- Dentural Development Model 3-6 Years Old
- Dentural Development Model 5-9 Years Old
- Dentural Development Model 9-12 Years Old

Facilitation Steps:

1. Set the models out on various tables before or at the beginning of class.
2. Divide participants into groups to move around each table to examine each model.
3. Have participants examine each model and attempt to identify different structures on each model. Participants should spend two minutes at each table as this is just to test what they may already know and familiarize themselves with what each structure looks like.

Lesson Two – Dental Morphology

LEARN: Dental Morphology Lecture

45 minutes

Purpose:

Participants will receive a thorough introduction to basic tooth anatomy and structures of the primary and permanent dentitions. They will learn what constitutes as normal occlusion, clinical considerations for each structure, how to identify various landmarks on a model, and how to use the main numbering systems.

Materials:

- *Dental Morphology* slide presentation
- *Dental Morphology Presentation Guide*
- *Dental Morphology Presentation Guide* – Answer Key

Facilitation Steps:

1. Share the following information as you show the slide presentation. Give each participant the *Dental Morphology Presentation Guide* for notetaking during the presentation.

Slide 1: Introduction slide.

Slide 2: Goals and Objectives

- Identify tooth anatomy, structure of the teeth, and primary and permanent dentitions
- Recognize normal occlusion and the relationship between maxilla and mandible in movement
- Demonstrate the use of the Universal and Palmer tooth numbering systems

Slides 3-4: Overview of Dentitions

There are two main dentitions. Primary teeth are also known as the primary dentition, deciduous teeth, or “baby teeth”. Children present with incisors, canines, and molars. Permanent teeth are also known as the permanent dentition or “adult teeth”. Adults present with the same tooth types as children, plus premolars.

Dentition: natural teeth in the jaws

Primary teeth: first teeth present

- **Incisors:** first and second anterior teeth from midline (centrals and laterals)
- **Canines:** anterior teeth that are the third from midline in each quadrant
- **Molars:** most posterior teeth with firsts, seconds, and thirds

Permanent teeth (aka permanent dentition, adult teeth): second and final dentition with all the permanent/adult teeth present

- **Premolars:** fourth and fifth posterior teeth from midline in permanent dentition, including firsts and seconds or bicuspid; no deciduous counterpart in primary dentition

Teeth comprise approximately 20% of the surface area of the oral cavity, maxillary teeth more than mandibular teeth. Succedaneous permanent teeth erupt lingual to the roots of shedding primary teeth.

Anterior teeth: incisors and canines at the front of the oral cavity

Posterior teeth: premolars and molars in the back of the mouth

Succedaneous: permanent teeth with primary predecessors (anterior teeth and premolars)

Nonsuccedaneous: permanent teeth without primary predecessors (molars)

Slide 5: Dentition Periods

Dentition period assignment allows for the most effective dental treatment for that period. The consideration of the specific period is of great importance for orthodontic therapy so that growth during certain periods can be maximized, allowing expansion of the jaws and movement of the teeth.

Full eruption of the primary dentition is typically completed at 30 months old, usually when the primary second molars are in occlusion. Jaws

are beginning to grow during this period to accommodate the coming larger and more numerous permanent teeth. This period ends when the first permanent tooth erupts, typically the permanent mandibular first molar. **Dentition Periods:** three periods that occur throughout lifetime (primary, mixed, and permanent)

Primary dentition period: only primary teeth are present with this dentition

- Begins with the eruption of the primary mandibular central incisors
- Occurs between 6 months and 6 years old
- Full eruption completed at 30 months
- Jaws begin to grow
- Ends when the first permanent tooth erupts

Slide 6: Clinical Considerations for Eruption Process

Permanent teeth start to erupt usually before the primary tooth is fully shed. This can create complications with spacing. Early dental consultation is necessary for interceptive orthodontic therapy if a child patient presents with prolonged retention. Another issue that may arise is a retained root fragment. The presence of the fragment may create periodontal complications. Mouth guards are beneficial to prevent damage to erupting/forming permanent teeth, as well as their roots, as their roots take longer to form.

Above are more prominent complications during the eruption process. An eruption cyst may also occur.

An eruption cyst is a dentigerous cyst that forms around a partially erupted tooth. It is a fluctuant, blue, vesicle-like gingival lesion that disintegrates upon eruption of the tooth. No treatment is needed for this type of dentigerous cyst.

Nasmyth membrane: a green-gray residue on newly erupted teeth that may become extrinsically stained

- Consists of fused tissue of the REE and oral epithelium

- Easily picks up extrinsic stains from food debris
- Can be removed by selective polishing

Dentigerous cyst: odontogenic cyst that forms from reduced enamel epithelium (layers of flattened cells overlying enamel surface) after the crown has completely formed and matured

- Initially asymptomatic
- Forms around the crown of a nonerupted tooth (whether developing or impacted)
- Commonly occurs around the third molars
- May cause displaced teeth, jaw fracture, and pain as it grows larger
- Must be completely removed surgically

Slide 7: Mixed Dentition Period

During this period, both shedding of primary teeth and eruption of permanent teeth begin after their crowns are completed. This period begins with the eruption of the first permanent tooth and ends with the shedding of the last primary tooth, which usually occurs around 11-12 years old. During this period, the jaws undergo the fastest and most noticeable growth to accommodate the larger size and number of permanent teeth. These rapid changes are all consistent with the onset of puberty.

This mixed dentition period is sometimes called the “ugly duckling” phase, as the variation of tooth sizes, shades, and spacing is visibly evident. The crowns of primary teeth are much lighter in color than their permanent counterparts. This is due to permanent teeth having less opaque enamel; thus, the underlying yellow dentin is more visible.

Women tend to shed primary teeth and receive permanent teeth slightly earlier than men.

Mixed dentition period: transitional stage involving the dentition when both primary and permanent teeth are present

- Occurs between 6 and 12 years old
- Primary teeth shed
- Permanent teeth erupt
- Jaws undergo fastest and most noticeable growth

Variations noted between primary teeth and permanent teeth:

- Color
- Crown size
- Root length

Slide 8: Clinical Considerations for Mixed Dentition Period

The mixed dentition is sometimes considered the “ugly duckling” stage because of the differing tooth colors, disproportionately sized teeth, and various clinical crown heights. Temporary edentulous areas and crowding are often present in a patient’s smile as well. Gingivitis and general gingival inflammation is often present due to response from all of these oral changes and hormonal fluctuations, especially during puberty.

Homecare may be difficult due to crowding or presence of orthodontic treatment. Panoramic radiographs are important for monitoring tooth development, so early interceptive orthodontic therapy may be initiated if necessary.

Aggressive periodontitis/juvenile periodontitis: condition in which evidence of bone loss is consistent around newly erupted permanent first molars and mandibular anteriors

- Bone loss is severe
- Presence of gingival inflammation and plaque biofilm is slight/minimal
- Underlying serious periodontal condition needing early intervention to prevent further bone loss

Slide 9: Permanent Dentition Period

During this period, all permanent tooth eruption is complete, except for those that are congenitally missing or impacted and cannot erupt. Tooth types tend to erupt in pairs, so if any asymmetry exists in a patient, a radiograph of the area may be required to determine if the teeth are congenitally missing, impacted, etc.

Growth of jaws is not as noticeable because growth slows and eventually stops. When a child patient is unusually early or late regarding the usual sequence of eruption, the biological family dental history should be reviewed for developmental anomalies.

Permanent dentition period: final stage in the dentition with all the permanent teeth present

- Begins with shedding of the last primary tooth
- Begins after 12 years of age
- Eruption of all permanent teeth
- Tooth types tend to erupt in pairs

Slide 10: Tooth Numbering

Pictured is a chart of the Universal Numbering System, the International Numbering System, and the Palmer Notation Method.

Slides 11-12: Universal Numbering System (UNS)

For the primary dentition, each tooth is designated from each other in a consecutive arrangement using capital letters A through T starting with the maxillary right second molar, moving clockwise, and ending with the mandibular right second molar. For the permanent dentition, each tooth is designated from each other in a consecutive arrangement using digits 1 through 32 starting with the maxillary right third molar, moving clockwise, and ending with the mandibular right third molar.

Universal Numbering System (UNS):

numbering system for permanent teeth using Arabic numerals 1 through 32 and for primary teeth using capital letters A through T

- Most widely used in the U.S.
- Designated in consecutive arrangement
- Primary = A through T
- Permanent = 1 through 32
- Also used when charting restorations or periodontal conditions

See Slide 12 for a diagram of the Universal Numbering System (UNS)

Slides 13-14: International Numbering System (INS)

In this numbering system, the first digit indicates the quadrant. Digits 1 through 4 are used to designate the quadrants in a clockwise manner for the permanent dentition and 5 through 8 in a clockwise manner for the primary dentition. The second digit indicates the tooth’s position in the

quadrant. Digits 1 through 8 are used for permanent teeth and digits 1 through 5 are used for primary teeth, starting at the midline and numbering in a distal direction.

International Numbering Systems (INS): international system for tooth designation using a two-digit code

- First digit indicates the quadrant
 - Digits 1-4 for permanent dentition
 - Digits 5-8 for primary dentition
- Second digit indicates the tooth's position in the quadrant:
 - Digits 1-8 used for permanent teeth
 - Digits 1-5 used for primary teeth

See Slide 14 for a diagram of the International Numbering System (INS).

Slides 15-16: Palmer Notation Method

This system is helpful with the orthodontic specialty because it allows immediate discussion of the teeth that require prompt treatment. Teeth are designated with a right-angle symbol indicating the quadrants and arch with the tooth number placed inside (similar numbering to the INS).

Palmer Notation Method: system of tooth designation commonly used in orthodontics; the oral cavity is divided into quadrants and each tooth is designated by a numeral 1 to 8

- Most used in orthodontics
- Produces an easy-to-navigate graphic mapping of dentition
- Teeth designated with a right-angle symbol

See Slide 16 for a diagram of the Palmer Notation Method.

Slide 17: Tooth Designation

As we discussed in the first lesson, occlusion is the method by which the teeth of the maxillary arch meet the teeth of the mandibular arch. However, it can also be used to describe the anatomic alignment of the teeth and the relationship to the rest of the masticatory system. Teeth can be described by their position

in each dental arch and their relationship to the midline as well (incisors and canines are anterior teeth because they're closer to the midline; molars and premolars are posterior teeth because they're farther from the midline). Teeth are described as being in one of the four quadrants: maxillary right quadrant, maxillary left quadrant, mandibular right quadrant, mandibular left quadrant.

Designating teeth into sextants is beneficial to follow the mapping of the oral nerve pathways (especially in the maxillary arch). It is useful in dental treatment plans, such as those involving the use of local anesthesia for patient pain control.

Orientation of the dental chart is from the dental professional's view, however "left" and "right" on a chart correspond to the patient's left and right, respectively.

Occlusion: used to describe the anatomic alignment of the teeth and the relationship to the rest of the masticatory system

Quadrants: division of each dental arch into two parts with four quadrants in oral cavity

- Maxillary right quadrant
- Maxillary left quadrant
- Mandibular right quadrant
- Mandibular left quadrant

D-A-Q-T System: system to designate teeth:

- D for dentition
- A for arch
- Q for quadrant
- T for tooth type

Sextants: dental arch division into three parts based on relationship to midline:

- Right posterior sextant
- Anterior sextant
- Left posterior sextant

Slide 18: Tooth Anatomy Terms

The enamel of a crown and the cementum of a root meet close to the cemento-enamel junction (CEJ). The CEJ feels smooth, grainy or has a slight groove when explored. There are three possible interfaces at the CEJ; multiple situations are possible on one tooth or even one

surface of a tooth. The cementum over the neck of each tooth may overlap the enamel, the enamel may meet the cementum edge to edge, and/or a small area of underlying dentin may be exposed due to a gap between the enamel and cementum.

The height of a clinical crown can change over time, due to gingival recession for example. The clinical root is also subject to variability over time, again related to gingival recession.

CEJ: external line at the neck or cervix of the tooth

Three possible interfaces at the CEJ:

1. Cementum overlaps enamel
2. Enamel and cementum meet edge to edge
3. Gap between enamel and cementum

Anatomic crown: part of crown covered by enamel

Clinical crown: part of the anatomic crown that is visible in the oral cavity and is not covered by gingival tissue

- Height is determined by the location of the marginal gingiva
- Can change over time

Anatomic root: part of the root covered by cementum

Clinical root: part of anatomic root visible in the oral cavity and not covered by gingival tissue

- Can change over time

Slide 19: Root Anatomy Terms

Teeth may have one or more root, but all the roots of both dentitions have common traits.

Root axis line (RAL): imaginary line representing a long axis line of a tooth drawn to bisect the root (and crown) into two halves

Root traits:

- Roots are widest at the CEJ and taper toward the apex of the tooth
- Roots have more bulk on the facial surface compared to the lingual surface

- Roots taper more dramatically on the lingual surface

Root concavities: indentations on the surface of the root

- Occur on proximal root surfaces of anteriors and posteriors
- Occur on buccal and lingual surfaces of molars
- Furcation = an area between two or more of these roots

Slide 20: Clinical Considerations for Tooth Anatomy

Certain restorations should cover the entire anatomic crown, such as a full artificial crown. Loss of anatomic crown structure or enlarged gingival tissue may affect the placement of a crown.

Crown lengthening: a surgical periodontal procedure that increases the amount of the clinical crown and reduces the surrounding gingival tissue

Slides 21-22: Orientational Tooth Terms

Each tooth has five surfaces: facial, lingual, masticatory, mesial, and distal

Masticatory surface: chewing tooth on the most superior surface on the crown

Incisal surface: masticatory surface for the anterior teeth

Occlusal surface: masticatory surface of the posterior teeth

Ridges: linear elevations on the masticatory surface of either the anterior or posterior teeth

Cusp: one or more elevations on the masticatory surface of the canine and posterior teeth

- Maxillary and mandibular canines both have one cusp
- Maxillary premolars and mandibular first premolars usually have two cusps
- Mandibular second premolars frequently have three cusps, one buccal and two lingual
- Maxillary molars have two buccal cusps and two lingual cusps

- Mandibular molars have four or five cusps

A minor fifth cusp may form on maxillary molars called the *cusp of Carabelli*.

Surfaces of the crown and root may also be defined by relationship to the midline

Mesial: surface of the tooth closest to the midline

Distal: surface of the tooth farthest away from the midline

Proximal: mesial and distal surface between adjacent teeth

Interproximal space: area between adjacent tooth surfaces

Contact area: tooth anatomy where adjacent tooth crowns in same arch physically touch each proximal surface

Height of contour: crest of curvature that is the greatest elevation of the tooth crown either incisocervically or occlusocervically; usually found at contact areas on the mesial and distal surfaces

Thirds: crown surface or root division into three parts (crown horizontally and vertically and root horizontally)

Slide 23: Embrasures

Contact areas, height of contour, and embrasure spaces serve to shelter the vulnerable gingival sulcus area from damage and help to stabilize the position of the teeth within each dental arch.

Embrasures: triangle-shaped spaces from curvatures where two teeth in same arch contact

- Form spillways between teeth to direct food away from the gingiva
- Provide a mechanism for teeth to be more self-cleansing
- Protect gingiva from undue frictional trauma, but still provide the proper degree of stimulation to the tissue

Slide 24: Naming Line Angles

When combining terms such as *distal* and *facial*, the *al* from the end of the first surface is dropped and replaced with an *o* and then combined with

the second surface, creating *distofacial* for example. Posterior teeth have eight line angles per tooth: mesiobuccal, distobuccal, mesiolingual, distolingual, mesio-occlusal, disto-occlusal, bucco-occlusal, and linguo-occlusal. Anterior teeth have six line angles: mesiolabial, distolabial, mesiolingual, distolingual, labioincisal, and linguoincisal. Anterior teeth have fewer line angles because the mesial and distal incisal line angles are rounded/non-existent.

Line angle: line formed by the junction of two crown surfaces

- Name derived by combining the names of the two surfaces:
 - When combining terms such as *distal* and *facial*, the *-al* is dropped
 - *Al* replaced with an *o* and then combined with the second surface
 - *Distal* + *facial* = *distofacial*
 - If the first letter of the second word results in a double vowel, a hyphen is used (*mesio-occlusal*)
- Accepted sequence of combined names:
 - Mesial precedes distal
 - Mesial and distal precede all other terms
 - Labial, buccal, and lingual follow mesial/distal, but precede incisal or occlusal

Point angle: imaginary line formed by the junction of three crown surfaces

- Teeth have four point angles
 - Example: *mesiolabioincisal* for an anterior tooth or *mesiobucco-occlusal* for a posterior tooth

Slide 25: Tooth Functions

Tooth functions are based on the tooth's shape/form. Incisors have a triangular form to their crowns. Canines have a tapered shape with prominent cusps. Premolars also have prominent cusps but have a wide masticatory surface. Molars have the largest and strongest crowns.

- **Incisors:** biting and cutting food

- **Canines:** piercing and tearing food
- **Premolars:** assist canines in piercing/tearing food; assist molars in grinding food
- **Molars:** grinding food

Slide 26: Clinical Considerations for Tooth Structure

If a tooth is lost or extracted in the permanent dentition, replacement is necessary to maintain structure and function of the dentition affected as to not affect mastication. A mold of the restored tooth is necessary to ensure proper fit within the dental arch.

Tooth form and its related function may be lost due to:

- Attrition
- Trauma
- Caries
- Extraction/tooth loss

Restorative treatment for an extracted/lost tooth includes:

- Artificial crowns
- Bridges
- Partial/complete fixed or removable dentures
- Implants

Slides 27-28: Occlusion

Substantial range of movement of the mandibular condyle within the TMJ contributed to variations of possible tooth contact. Occlusion pattern develops in a child as the primary teeth erupt. Oral motor behaviors develop, and masticatory skills are acquired in this time. Other factors that may affect occlusion pattern: associated musculature, neuromuscular patterns, TMJ functioning, tongue functioning and posturing, orofacial behaviors, and habit patterns.

Abnormal pressure from the tongue or force of movement from the tongue (i.e., tongue thrusting or incorrect resting posture of the tongue) can also create occlusal disharmony. Open mouth posture/chronic mouth breathing results in inadequate closure of the lips which is needed to maintain an equilibrium between the lips and the teeth.

When teeth are in CO, each tooth of one arch is in occlusion with two others in the opposite arch (except for the mandibular central incisors and the maxillary third molars). This structure equalizes forces of impact in occlusion. It also temporarily maintains alignment of the opposing jaw if a tooth is lost in one jaw. If a tooth is not replaced, the neighboring teeth tend to tip to fill the edentulous space. Teeth will then become inclined, malaligned, or supereruption of the tooth in the opposing space may occur.

Occlusion: anatomic alignment of teeth and relationship to masticatory system; the contact relationship between the maxillary teeth and mandibular teeth when the jaws are fully closed (occluded) in position

- Many patterns of tooth contact are possible

Centric occlusion: voluntary position of dentition that allows maximal contact when teeth occlude; habitual occlusion

- Centered contact position of the occlusal surfaces of mandibular teeth on the occlusal surface of the maxillary teeth
- When teeth are in CO, each tooth of one arch is in occlusion with two others in the opposite arch
 - Mandibular central incisors and maxillary third molars are the only teeth not in occlusion

The range of motion (ROM) is the maximum extent to which parts of the TMJ can move when opening and closing. It keeps the soft tissue of the oral cavity out of the way during mastication. The maximum ROM and MMO is relative to patient's size.

Overjet: maxillary arch horizontally overlaps mandibular arch

- Usually overlaps 1-3 mm

Range of motion (ROM): normal physiologic and functional reciprocal range of motion/movement for mandibular opening or closure

- Measured in degrees of a circle

Overbite: maxillary arch vertically overlaps mandibular arch

- Usually 2-5 mm
- Expressed as percentage, usually 20-30%

Underbite: when the lower jaw extends forward beyond the upper jaw

Maximum mouth opening (MMO): the greatest amount of interincisal opening of the mouth

- Range = 40-50 mm (approximately the ability to position three fingers into the mouth: index, middle, and ring fingers)

Slide 29: Curves and Angulations

The concept of arch formation allows arches to overlap slightly so that the canines and first molars are cooperating in more than one segment as they act as the anchor supports of both arches. Dental arches are not flat planes. The maxillary arch is convex occlusally and the mandibular arch is concave. When teeth come into CO, they align anteroposterior and lateral curves. As one ages, they tend to lose the curve because of attrition. Dental professionals refer to a singular *occlusal plane* instead.

The arch is divided into anterior, middle, and posterior segments:

Anterior segment = anterior teeth

Middle segment = premolars

Posterior segment = molars

Curve of Spee: anteroposterior curvature produced by planes placed at the masticatory surfaces of each dental arch

- Evident when viewing posterior teeth from the buccal view

Curve of Wilson: concave curve produced when the frontal section is taken through maxillary and mandibular molars

Slide 30: Centric Stops and Relation

Supporting cusps include the lingual cusps of the maxillary posterior teeth, the buccal cusps of the mandibular posterior teeth, and the incisal edges of the mandibular anterior teeth. Centric stops and supporting cusps are checked with articulating paper. Occlusal adjustments may be necessary following restorative work depending

on the occlusal evaluation. *Wear facets*, or flat surface contacts, may result over time when the centric stops are worn due to attrition.

Centric stops: centric contacts between the two arches that includes height of cusp contour, marginal ridges, and central fossae

- **Supporting cusps:** cusps that function during centric occlusion

Centric relation (CR): end point of closure of the mandible in which the mandible is in most retruded position

- Patient rarely in CR but is useful for evaluating

occlusion as it can be easily repeated

- Ideally when the mandible is in CR, dentition is in CO
- **Premature contacts:** situation in which one or two teeth initially contact before other teeth

Slide 31: Lateral and Protrusive Occlusion

Two working sides are noted during an occlusal evaluation: the right lateral and left lateral. A canine rise is pictured on the slide.

Lateral occlusion: movement that occurs when mandible moves to the side until the canines are in a cusp-to-cusp relationship

Working side: side to which mandible has been moved during lateral occlusion

Balancing side: other side of the arch from the working side during lateral occlusion; nonworking side

Canine rise: contralateral canine should be the only tooth in function during lateral occlusion

- If the canine rise does not exist due to wear, group function is noted

Group function: entire posterior quadrant functions during lateral occlusion

- All opposing posterior teeth share occlusal stress
- No teeth should make contact on the contralateral balancing side

Balancing interference: teeth in contact on balancing side during lateral occlusion

Protrusive occlusion: occlusion when mandible undergoes protrusion

Slide 32: Mandibular Rest Position

2-3 mm of average space noted between masticatory surfaces of maxillary and mandibular teeth during the rest position

Interocclusal clearance: space between dental arches when the mandible is at rest, aka *freeway space*

Resting posture: normal physiologic position of tongue, lips, and mandible when not in function of chewing, swallowing, or speech

- Tongue resting on the palate, teeth not in occlusion, and lips are gently closed without any signs of facial grimacing

Interlabial gap: distance between inferior border of upper lip and superior border of lower lip when at physiologic resting position

Slide 33: Primary Occlusion

Terminal plane: ideal molar relationship in primary dentition when in centric occlusion

Ideal relationships:

Flush terminal plane: terminal plane relationship where primary maxillary and mandibular second molars are in an end-to-end relationship

Mesial step: terminal plane relationship with primary mandibular second molar is mesial to maxillary molar

Distal step: no terminal plane relationship exists because the primary mandibular second molar is distal to the maxillary second molar

- A distal step is *not* ideal

Primate spaces: spacing is beneficial to allow for room for the permanent dentition to erupt and allows for room for movement so that the teeth fall into a mesial step

Primate spaces are present between the maxillary lateral incisors and the maxillary canines and between the mandibular first molars and mandibular canines.

Slide 34: Clinical Considerations for Occlusion

Picture shows craze lines (small fracture lines) from unbalanced occlusal stress.

- Occlusal disharmony results from malalignment, orofacial myofunctional imbalances, and/or parafunctional habit patterns
- Teeth may lose proper function and ability to self-cleanse, while also resulting in unnatural occlusal stress

Occlusal trauma: trauma to periodontium from occlusal disharmony

- Can initiate or contribute to an already weakened and diseased periodontium

Slide 35: Malocclusion Classifications

An orthodontist may collaborate with an orofacial myologist or speech therapist to correct some malocclusions. Crowding is the number one most common form of malocclusion. Excessive overjet of the maxillary incisors is the second most common form of malocclusion. It affects approximately 15% of children and teenagers.

Negative space is desirable in the posterior region where no light enters, which highlights the rest of the smile. An example of undesirable negative space would be from shadows on other teeth due to crowding.

Malocclusion: failure to have overall ideal form to the dentition while in centric occlusion (CO)

- May have a negative impact on patient's appearance
- May increase difficulty to perform adequate homecare
- Stems from hereditary factors
- 80% of children and teenagers show some degree of malocclusion
- Crowding affects 40% of children and 80% of teenagers

Smile design factors: gender, symmetry of color/shape, position of teeth in relationship to midline, presence of negative space

Angle classification of malocclusion: system used to initially classify malocclusion

- Specifically, malocclusion of molars and canines
- Does not describe lateral or protrusive discrepancies
- Assumes patient is occluding in CO (which does not address potential discrepancies between CR and CO)
- Initial baseline classification and *not* a complete diagnosis

Slides 36-37: Class I Malocclusion

In this classification, the mesiobuccal cusp of the maxillary first molar occludes with the mesiobuccal groove of the mandibular first molar. The maxillary canine occludes with the distal half of the mandibular canine and the mesial half of the mandibular first premolar. The minor dental malalignments present are typically due to crowding or irregular spacing within the jaws.

Class I malocclusion: malocclusion characterized by ideal mesiodistal relationship of jaws and dental arches with minor dental malalignments

- Due to crowding or irregular spacing within the jaws

Mesognathic: facial profile in centric occlusion with slightly protruded jaws, giving facial outline a relatively flat appearance or straight profile

Gnathic: measurement that gives a degree of maxillary arch prominence as opposed to the mandible

- *Mesial drift* (aka physiologic drift) = movement phenomenon in which all the teeth move slightly and slowly toward the midline of the oral cavity over time
- This can cause crowding later in life even if previous occlusion was ideal

Open bite: malocclusion due to the anterior teeth of both dental arches not occluding

End-to-end bite: teeth that occlude without maxillary teeth overlapping mandibular teeth

- Can occur both anteriorly and posteriorly, unilaterally or bilaterally
- Anterior teeth of both jaws meet along their incisal edges when teeth are in CO

Crossbite: malocclusion in which mandibular tooth/teeth are placed facially to maxillary tooth/teeth

- Can occur both anteriorly and posteriorly, unilaterally or bilaterally
- Individual teeth may be slightly deviated labially or lingually; they may be in labioversion or linguoversion

Slide 38: Class II Malocclusion

The distal surface of the mandibular canine is distal to the mesial surface of the maxillary canine by at least a width of a premolar. If the width is less than a premolar, the misalignment can be noted as a *tendency*. There are two subgroups of this classification based on the position of the anterior teeth, shape of the palate, and the resulting facial profile.

Class II malocclusion: malocclusion with mesiobuccal cusp of the maxillary first molar occluding by more than the width of a premolar mesial to the mesiobuccal groove of the mandibular first molar

- Less than a premolar, can be noted as a *tendency*

Two subgroups:

Class II malocclusion, division I: Class II malocclusion with permanent maxillary anterior teeth protruding facially

- Severe overbite (deep overbite) usually present
- Palate often narrow and V-shaped

Retrognathic: facial profile with protruding upper lip with recessive mandible and chin and convex profile

Class II malocclusion, division II: class II malocclusion with maxillary central incisors either upright or retruded

- Laterals tend to be tipped labially or overlap the central incisors
- Deep overbite, but palate tends to be average shape/width

Slide 39: Class III Malocclusion

The distal surface of the mandibular canine is distal to the mesial surface of the maxillary canine by at least a width of a premolar. If the width is less than a premolar, the misalignment can be noted as a *tendency*. There are two subgroups of this classification based on the position of the anterior teeth, shape of the palate, and the resulting facial profile.

Class III Malocclusion: malocclusion with mesiobuccal cusp of maxillary first molar occluding by more than width of a premolar distal to mesiobuccal groove of mandibular first molar

- Distal surface of mandibular canine is mesial to the mesial surface of the maxillary canine by at least the width of a premolar
- Mandibular incisors are usually complete crossbite

Prognathic: facial profile with rather prominent mandible and possibly normal or even retrusive maxilla, or concave profile

Slides 40-41: Clinical Considerations for Parafunctional Habits

These habits tend to occur subconsciously, like when a person is sleeping, driving, watching TV, using the computer, reading, etc. Stress is a major contributing factor. Approximately 20-30 lbs per square inch of pressure is exerted during mastication, but subconscious grinding can exert up to 200 lbs per square inch which can cause damage over time.

Patients with habitual bruxism should use a night guard while sleeping to protect the integrity of their tooth enamel and the surrounding soft tissue. An oral splint for daytime use may be necessary if bruxism is consistently occurring throughout the day as well.

Abfraction is present in the slide.

Parafunctional habits: mandible movements not within normal motions associated with mastication, speech, or respiratory movements

Clenching: parafunctional habit with teeth held in centric occlusion for long periods without mandibular rest or interocclusal clearance

Bruxism: parafunctional habit of tooth grinding (forceful meshing of the teeth)

- Can lead to *attrition*, *wear facets*, and enlarged masseter muscles

Attrition: hard tooth tissue loss caused by tooth-to-tooth contact during mastication or parafunctional habits

- Can lead to *gingival recession* or *abfraction*

Gingival recession: inferiorly placed margin of the free gingival crest

Abfraction: hard tooth tissue loss from tensile and compressive forces during tooth flexure; shearing or flaking of the enamel surface

Studies have found prevalence of OMDs in approximately 38% of the general population and approximately 81% in children presenting with speech difficulties.

Lip incompetence may lead to mouth breathing.

The length of the lingual frenum is another issue that may cause occlusal disharmony. It may cause low and forward tongue resting posture. It may also affect the shape of the palate and contribute to an anterior open bite or the development of a crossbite. Incorrect functional speech patterns and articulation difficulties, as well as challenges feeding as an infant are all risk factors of ankyloglossia.

The goal for all parafunctional habits is for them to be addressed and eliminated before eruption of the permanent incisors (around age 6).

Orofacial myology (OM): specialized professional discipline that evaluates and treats a variety of orofacial muscle postural and functional disorders as well as habit patterns that may contribute to the disruption of dental development and can present orofacial aesthetic challenges

Orofacial myofunctional disorder (OMD):

behaviors and patterns created by inappropriate muscle function and incorrect habits involving tongue, lips, jaws, and face

Orofacial myofunctional therapy (OMT):

variety of exercises are involved that are based on individual evaluation and treatment protocols to eliminate orofacial myofunctional disorders

Tongue thrust: incorrect patterning during tongue function resulting in parafunctional habit

Retained sucking habit: parafunctional habit includes digit and pacifier use past the age of 2

Lip incompetence: open mouth with lips apart, as resting posture

Ankyloglossia: lingual frenum with abnormal short attachment

Slides 42-44: Permanent Anterior Teeth Morphology

All anterior teeth are composed of four developmental lobes, three labial lobes (mesiolabial, middle labial, and distolabial) and one lingual lobe. Two vertical labial developmental depressions outline the separations between the labial developmental lobes (the mesiolabial and distolabial developmental depressions).

Consist of the incisors and canines.

Common characteristics of all anterior teeth:

- Crown outline of anterior teeth is triangular when viewed from the proximal (apex at the incisal ridge and base of the triangle at the cervix)
- Wider mesiodistally than labiolingually
- Height of contour is in the cervical third
- CEJ curvature of all anteriors is greater than that of posteriors
- Anterior teeth usually have one root

The long crown of an anterior tooth has an incisal surface, which is considered the incisal ridge.

The cingulum corresponds to the lingual developmental lobe.

The more anterior the tooth, the fewer supplemental grooves.

Developmental depression: depression usually evident in a specific tooth area

Incisal ridge: linear elevation on the incisal or masticatory surface of incisors when newly erupted

Cingulum: raised and rounded area on the cervical third of the lingual surface on the anterior teeth

Marginal ridge: rounded, raised borders on the mesial and distal parts of the lingual surface of the anterior teeth or the occlusal table of the posterior teeth

Fossa (fossae, plural): shallow, wide depression(s) on the lingual surface of the anterior teeth or the occlusal table of the posterior teeth

Developmental pits: pits on the lingual surface of the anterior teeth or on the occlusal table and buccal as well as lingual surfaces of the posterior teeth; deepest part of each fossa

Developmental groove: primary groove that marks junction among developmental lobes on lingual surface of the anterior teeth or occlusal table of the posterior teeth; sharp, deep, V-shaped linear depression

Supplemental groove: secondary groove on the lingual surface of the anterior teeth and the occlusal table on the posterior teeth; shallower, more irregular linear depression than developmental groove

Slide 45: Permanent Incisors

The crown outline of an anterior tooth is trapezoidal when viewed from the labial and lingual, with only two parallel sides. The longer of the two parallel sides is toward the incisal surface.

Permanent maxillary incisors have larger crowns than their mandibular counterparts. Their labial surfaces are rounder from the incisal aspect. There are also more prominent marginal ridges, lingual fossa, and cingulum present on maxillary incisors than mandibular incisors.

Mamelons: rounded enamel extensions on the incisal ridge of the anterior teeth

- Extensions from the three labial developmental lobes
- Become less detectable as teeth undergo wear over time

Incisal angles: two angles on permanent incisors formed from the incisal ridge or edge and each proximal surface

Incisal edge: flattened incisal ridge on permanent incisors due to attrition after eruption

Slide 46: Clinical Considerations for Permanent Incisors

Talon cusps contain a prominent pulp horn, which is at risk for pulpal exposure during restorative treatments.

An increased prominence of lingual marginal ridges and a deeper lingual fossa contributes to supragingival tooth deposits. Deep lingual pits are at an increased risk of developing dental caries (cavities). Tongue thrust and lip incompetence may affect maxillary incisors, as well.

Hutchinson incisors: developmental disturbance in permanent incisors with screwdriver-shaped crowns caused by congenital syphilis

- A pregnant woman presenting with syphilis may transmit spirochete onto the fetus via the placenta
- Other effects include blindness, deafness, and paralysis

Talon cusps: sharp, small extra cusp occasionally appears as a projection on the cingulum of incisor teeth

- Can interfere with occlusion

Slide 47: Characteristics Specific to Maxillary Centrals

#8 and #9 erupt between 7 to 8 years old. Root completion occurs around age 10.

Each of these teeth have a single conical root with a rounded apex and one considerably large root canal. Its pulp chamber has three sharp elongations: the mesial, distal, and central pulp horns, which correspond to the three labial developmental lobes.

The difference in sharpness helps to distinguish the maxillary right central incisor from the left. From the lingual view, a single cingulum is wide and well-developed in size. It is slightly off-center towards the distal. The CEJ curvature on the mesial surface has the greatest depth of curvature of any tooth surface in the permanent dentition.

- Most prominent teeth in permanent dentition due to size and position in arch
- Widest crown mesiodistally of any permanent anterior tooth
- Imbrication lines (slight ridges) run mesiodistally from labial view
- **Incisal angles:** mesial outline has a sharp mesioincisal angle; distal outline has definite rounded distoincisal angle
- CEJ curvature on mesial surface has the greatest depth of curvature of any tooth surface in the permanent dentition

Slide 48: Clinical Considerations for Permanent Maxillary Centrals

The incisal ridge of a permanent maxillary central incisor is especially at risk for traumatic fracture due to their position in the dental arch as well as how early they erupt within the oral cavity.

Avulsion: complete tooth displacement from the socket due to extensive trauma

Pulpal pathology may occur in a tooth even if only fractured, which may result in the need for endodontic treatment to avoid loss of tooth vitality

Diastema: open contact that can exist between permanent maxillary central incisors

Mesiodens: supernumerary tooth between two permanent maxillary central incisors

Slide 49: Characteristics Specific to Maxillary Laterals

#7 and #10 erupt between 8 and 9 years old. Root completion occurs around age 11.

Maxillary lateral incisors have a single conical root that is relatively smooth and straight but may curve slightly to the distal. They have a single pulp canal and pulp chamber with two less-sharp pulp horns (a mesial and distal pulp

horn). The difference in sharpness of its incisal angles help to distinguish the maxillary right lateral incisor from the left.

- Crown has the greatest degree of variation in form of any permanent tooth, except for the third molars
- Resembles a maxillary central incisor in all views, except smaller and less symmetrical
- Has a slightly rounder crown
- Both incisal angles are rounder on a lateral than a central
- Lateral's mesioincisal angle is sharper than the distoincisal angle
- Centered and narrower cingulum
- Deeper lingual fossa
- Pronounced marginal ridges

Slide 50: Clinical Considerations for Permanent Maxillary Laterals

- One of the most common teeth to exhibit microdontia
- One of the most common teeth to be congenitally missing

Peg laterals: lateral incisor crown that is smaller from partial microdontia

Slide 51: Characteristics Specific to Permanent Mandibular Incisors

- Smallest teeth of the permanent dentition
- Most symmetrical/uniform
- Mandibular lateral tends to be slightly larger than a mandibular central, which is the opposite of maxillary incisors
- Crown larger labiolingually than mesiodistally, also opposite of maxillary counterparts
- Less pronounced lingual surface features (cingulum, lingual fossa, and marginal ridges)

Slide 52: Characteristics Specific to Mandibular Centrals

#24 and #25 erupt between 6 and 7 years old. Root completion occurs around age 9.

These teeth have a simple root with a simple pulp cavity, a single pulp canal, and three pulp horns.

- Smallest and simplest teeth in the permanent dentition
- Crown has fan-shape from labial view
- Imbrication lines/developmental depressions very faint or not present at all
- Very difficult to differentiate between left and right mandibular incisors
- Mesioincisal angle is slightly sharper than distoincisal angle and CEJ curvature is higher incisally on the mesial than the distal surface

Slide 53: Characteristics Specific to Mandibular Laterals

#24 and #25 erupt between 7 and 8 years old. Root completion occurs around age 10.

These teeth have a single root usually straight and slightly longer and wider than central roots. They also present with a single pulp canal and three pulp horns.

These teeth have a simple root with a simple pulp cavity, a single pulp canal, and three pulp horns.

- Slightly larger overall than mandibular centrals
- More variation in form than mandibular centrals
- Not as symmetrical, appearing slightly tilted or twisted distally from both the labial and lingual views
- Mesioincisal angle is sharper than distoincisal angle
- More prominent lingual features than that of centrals
- One rare occurrence is that they may have an accessory root or bifurcated root (two root branches having labial and lingual orientation)

Slide 54: Clinical Considerations for Permanent Mandibular Incisors

Attrition may expose underlying dentin

- Exposed dentin is more porous and may easily become intrinsically stained
- Exposed dentin may also contribute to hypersensitivity

- Near the salivary duct openings, this contributes to an increased buildup of dental biofilm in this area

Slides 55-56: Permanent Canines

Canines appear triangular from the proximal view like all other anterior teeth. They appear pentagonal from the labial or lingual view.

- Aka the *eyeteeth* or *cuspid*s
- Yellower in color than incisors due to increased thickness and thus opaqueness
- Most stable teeth in the dentition with the longest root; provides stability and anchorage
- Very low risk of tooth loss as a result of periodontal disease or traumatic injury
- Often serve as stabilizing anchors for replacement of lost teeth in prosthetic procedures (i.e., partial dentures and permanent bridges)
- Important aesthetically because they hold the skin of the labial commissure in its position, which reduces the appearance of deep lip lines and wrinkles
- Pronounced form promotes self-cleansing; does not easily retain biofilm and deposits so unlikely to develop caries

The mesial cusp slope is usually shorter than the distal cusp slope. The mesial cusp slope of the maxillary canine occludes with the distal cusp slope of the mandibular canine. These teeth are the only teeth in the permanent dentition with a centrally placed vertical labial ridge.

- Larger cingulum than on incisors
- Longest teeth in the dentition
- Long and large root externally manifested by the *canine eminence*

Cusp tip: tip of cusp on the incisal surface of the canine teeth and occlusal table of the posterior teeth

Cusp slopes: two ridges on the incisal edge of the canine teeth divided by cusp tip

Labial ridge: central ridge on the labial surface of canines from the greater development of the middle labial developmental lobe

Lingual ridge: vertically oriented and centrally placed ridge that extends from the cusp tip to the cingulum on the lingual surface of the canine teeth

Slide 57: Characteristics Specific to Permanent Maxillary Canines

#6 and #11 erupt between 11 and 12 years old. Root completion occurs between 13 and 15 years old.

These teeth have a single root with a blunt apex, and a single pulp canal with one pulp horn. The entire crown and root of a maxillary canine is as long as a mandibular canine tooth, however the crown alone is slightly shorter than a mandibular canine.

- Crown is wider labiolingually than incisors, but noticeably narrower mesiodistally
- Larger and more developed cingulum than incisors
- Maxillary canine cusps are larger and more developed than mandibular canine cusps
- Sharper cusp tip than mandibular canines
- Entire lingual surface more prominent than mandibular canines
- Longest root in maxillary arch
- Mesial half of the crown resembles an incisor; distal half resembles a premolar
- Distal part of the crown appears thinner than the mesial

Slide 58: Clinical Considerations for Permanent Maxillary Canines

- May not have enough space to erupt at first so tend to erupt labially or lingually to surrounding teeth
- Sometimes may remain impacted within the alveolar process

Impacted: unerupted or partially erupted tooth positioned against another tooth, bone, or soft tissue preventing eruption

- A developmental cyst may then form around the impacted tooth

Slide 59: Characteristics Specific to Permanent Mandibular Canines

#23 and #26 erupt between 9 and 10 years old. Root completion occurs between 12 and 14 years old.

These teeth have a single root with one pulp horn but may have two pulp canals that can join at the apex.

- Crown may be longer than maxillary canine
- Longest mandibular root but shorter root than maxillary canine
- Not as rounded as maxillary canine
- Distal outline is shorter and rounder than mesial outline
- Rarely has lingual pits or lingual grooves
- Anterior tooth most likely to have a bifurcated root

Slides 60-61: Permanent Posterior Teeth Morphology

The crown of each posterior tooth has an occlusal surface as its masticatory surface, bordered by raised marginal ridges. These occlusal surfaces have two or more cusps.

Important anatomical terms for the posterior teeth:

Cusp ridges: ridge that descends from each cusp tip on the posterior teeth

Inclined cuspal planes: sloping planes located between cusp ridges on the posterior teeth

Occlusal table: part of the occlusal surface of the posterior teeth bordered by marginal ridges

Triangular ridges: cusp ridge that descends from the cusp tips toward the central part of occlusal table

Transverse ridge: ridge formed by the joining of two triangular ridges crossing the occlusal table transversely or from the labial to the lingual outline

Central fossa: fossa located at the convergence of cusp ridges in a central point on the occlusal surface of the posterior teeth

Triangular fossa: fossa that has a triangular shape where triangular grooves terminate

Developmental grooves are also found on the occlusal table. They are thought to mark the junction between developmental lobes. Supplemental grooves are also present. The more posterior a tooth, the more supplemental grooves. Grooves are sometimes called *fissures*. Pits and grooves/fissures put posterior teeth at an increased risk of caries developing.

Occlusal pits: sharp, pinpoint depression in fossae on the occlusal table of the posterior teeth

Central groove: most prominent developmental groove on the posterior teeth, traveling mesiodistally to separate occlusal table buccolingually

Marginal grooves: developmental grooves that cross either marginal ridge

Triangular grooves: groove that separates a marginal ridge from the triangular ridge of cusp and forms triangular fossae at the termination of the ridges

- Height of contour for the crown's buccal surface is the cervical third
- Height of contour for the crown's lingual surface is the middle third
- Most of the posteriors are wider labiolingually than mesiodistally, except for the mandibular molars
- CEJ curvature is less pronounced on posteriors than anteriors

Slide 62: Root Variations

Unlike anterior teeth, the roots of posterior teeth divide from the root trunk into the correct number of root branches for its tooth type. Bifurcated teeth with two roots have two furcation crotches and trifurcated teeth with three roots have three furcation crotches.

Multirrooted: teeth with two or more root branches

Root trunk: root of multirrooted teeth where the root originates from the crown

Bifurcated: tooth having two root branches

Trifurcated: tooth having three root branches

Root fusion: developmental disturbance that creates deep developmental grooves with root fusion

Furcation: area between two or more root branches before division from root trunk

Furcation crotches: spaces between roots at the furcation

Slide 63: Permanent Premolars

There are first premolars and second premolars; first premolars are closer to the midline. The crown outline from the buccal and lingual view is pentagonal.

- Aka *bicuspid*s
- Occlusal surface presents with cusps, marginal ridges, triangular ridges, developmental grooves, and occlusal pits

Buccal ridge: similar to labial ridge of canines; premolars have prominent centrally located vertical buccal ridge

- Height of contour is the cervical third on the buccal surface like all anteriors and the middle third on the lingual surface like all posteriors
- Most premolars have one root
- Maxillary first premolar has two roots
- If spacing is needed for an orthodontic treatment plan, first premolars are the teeth likely to be removed

Slide 64: Permanent Maxillary Premolars

Clinical Consideration: These teeth may penetrate the anterior part of the maxillary sinus due to accidental trauma or during tooth extraction, because of the close relation to the sinus walls.

- Maxillary first premolar is larger than maxillary second premolar
- Mandibular first premolar is smaller than mandibular second premolar
- Crown shorter occlusocervically
- Four developmental lobes: three buccal and one lingual
- Two cusps of equal size
- Hexagonal crown outline

Slide 65: Permanent Mandibular Premolars

- Do not resemble each other as much as maxillary premolars
- First premolar is smaller than second premolar (opposite of maxillary premolars)
- Buccal outline shows a strong lingual inclination when viewed from the proximal
- Outline is rhomboidal in shape
- May have more than two cusps, lingual cusps smaller if present

Slide 66: Permanent Molars

The first permanent molars are also known as *6-year molars* and the second molars are also known as *12-year molars* due to the ages they erupt. Third molars are also known as *wisdom teeth* and erupt between 17 and 21 years old. The eruption of the third molars marks the end of the growth of the jaws.

The molars support the soft tissue of the cheek, especially the facial muscles, because they maintain the height of the lower third of the vertical dimension of the face and alveolar process.

Because molars present with furcations, extra pits, etc., they are at a higher risk of developing periodontal complications.

- Largest teeth in the dentition
- Outline is trapezoidal from the buccal and lingual view
- First molar is the largest and each molar progressively gets smaller
- Each buccal surface has a prominent cervical ridge

Cervical ridge: ridge running mesiodistally in cervical 1/3 of buccal crown surface on primary dentition and permanent molars

- Molars do not exhibit buccal developmental depressions
- Molars have the most developmental grooves, supplemental grooves, occlusal pits, roots, cusps, etc.
- Present with furcation crotches

Slide 67: Permanent Maxillary Molars

A feature unique to the permanent maxillary molars is the presence of an oblique ridge. Maxillary molars are trifurcated, with the lingual root being the longest root branch. The farther distal a molar is in the maxillary arch, the shorter and more varied in size, shape, and curvature are the roots.

- Usually the first permanent teeth to erupt in maxillary arch
- Largest and strongest teeth of maxillary arch
- Wider buccolingually than mesiodistally
- Four major cusps: two on buccal and two on lingual

Oblique ridge: transverse ridge that crosses the occlusal table obliquely from mesiolingual to distobuccal on most maxillary molars

- Trifurcated
- Most common teeth to be involved in concrescence

Concrescence: union of root structure of two or more teeth through cementum only

Cusp of Carabelli: small cusp on the permanent maxillary first and second molar in some cases

Cusp of Carabelli groove: groove associated with a cusp of Carabelli

Slide 68: Permanent Mandibular Molars

- Wider mesiodistally than buccolingually
- Outline rectangular from occlusal view
- Bifurcated

Slide 69: Clinical Considerations for Permanent Molars

Third molars are the most impacted teeth

Mulberry molars: developmental disturbance resulting from congenital syphilis forming enamel nodules on the molars' occlusal surface

Ped molar: microdontia usually of the third molar

Slides 70-71: Primary Tooth Morphology

- 20 total primary teeth (10 per dental arch)
- Usually not present in the oral cavity at birth
- First eruption is usually a primary mandibular central incisor
- First eruption occurs between 6 and 10 months
- Primary spaces present
- Primary teeth are smaller overall than permanent teeth
- Important differences will be noted in upcoming slides but are mostly smaller versions of their permanent counterparts

The permanent dentition has 32 total teeth in comparison, with 16 teeth per dental arch.

It takes approximately 2-3 years for primary dentition to be complete, starting with the initial mineralization of the primary mandibular central incisors and is completed with the root formation of the primary maxillary second molar. There is a 6-month delay or acceleration granted and considered usual, as every child is different.

Actual dates are not as important as following the eruption sequence. It is important for teeth to erupt in pairs to monitor symmetry.

- Crown of any primary tooth is short in relation to its total length
- Crowns are more constricted at the CEJ, making them appear bulbous
- Occlusal table is narrower on primary teeth than permanent
- Contacts are broad and flat
- Roots are narrower mesiodistally and are no longer than the crown length
- Thinner dentin
- Teeth hold open the eruption arch spaces

The most prominent cervical ridge is found on both the labial and lingual surfaces of anterior teeth and the buccal surfaces of the molars, even more so than on permanent teeth.

Roots of primary teeth may show partial resorption as the teeth begin to shed, which can be noted radiographically. The mesial pulp horns

of primary molars are quite large. Primary pulp horns are relatively large in proportion compared to their permanent counterparts.

Slide 72: Clinical Considerations for Primary Teeth

Must be cautious of:

- Increased risk of pulpal exposure during cavity preparation, since the pulp chamber and pulp horns are larger
- Extraction due to presence of deeper developing tooth germs of the permanent dentition

Early childhood caries (ECC): extensive acute caries of primary teeth

Because enamel and dentin are thinner, the risk of endodontic complications is greater in the primary dentition.

ECC results from prolonged nighttime use of a baby bottle with a cavity-causing beverage or from sugar on a pacifier. A child's first dental appointment should take place within 6 months of the eruption of the first primary tooth, and no later than 12 months old. The initial appointment is important to provide the child's supervising guardian with information of home care methods and caries prevention.

Routine appointments are necessary as the child gets older to monitor exfoliation/eruption patterns. Early orthodontic intervention is monitored as well as the presence of retained baby teeth. Retained baby teeth may need to be removed.

Something to remind the child's guard of when teeth erupt is that permanent molars do not succeed any primary teeth and will erupt separately, distal to primary molars. It is important for patient education so neither the guardian, nor the child is missing the most posterior present teeth when performing home care.

Slides 73-75: Primary Teeth (With Differing Anatomical Features From Permanent Counterparts)

Significant features or differences from permanent counterparts will be noted in the following slides only.

Primary incisors may have extensive wear, but most children tend to grow out of the habit, or their occlusion changes and no longer affects incisa/occlusal edges.

Primary Incisors

- More prominent cervical ridges than permanent incisors

Primary Maxillary Centrals

- Crowns are wider mesiodistally than incisocervically; only anterior tooth in both dentitions with this crown dimension
- No mamelons
- No lingual pits
- Rarely presents with imbrication lines or developmental depressions
- CEJ curves distinctly toward the incisal
- Single root is round and tapers towards the apex

Primary Mandibular Centrals

- Quite symmetrical
- Crown tapers evenly from contact areas
- CEJ curvature greater on the mesial surface than on the distal

Primary Maxillary Laterals

- Similar in dimensions to primary centrals but smaller overall
- Longer incisocervically than mesiodistally, which is the opposite of primary centrals
- More rounded than centrals
- Longer root with a sharper apex

Primary Mandibular Laterals

- Similar in form as primary mandibular centrals but wider and longer
- More developed cingulum
- Deeper lingual fossa
- More rounded distoincisor angle

The roots of primary molars significantly flare out and separate widely, which usually leaves ample space available for the deeper developing permanent premolar crowns.

The crown of the primary maxillary first molar does not resemble any other crown in either dentition.

Primary Maxillary Canines

- Longer and sharper cusp than permanent maxillary canines
- Longer mesial cusp slope than distal cusp slope (opposite of permanent max. canine and primary mand. canine counterparts)
- Tubercle often present on the cingulum, extending from the cusp tip to the cingulum

Primary Mandibular Canines

- Much smaller labiolingually
- Smoother lingual surface

Primary Molars

- Crowns resemble permanent molars although they are replaced by permanent premolars
- Occlusal table more constricted buccolingually than permanent molar
- Roots flare out and are widely separated

Primary Maxillary 1st Molar

- Rounded mesial and distal outlines at the CEJ
- Extremely prominent buccal cervical ridge
- May have 3 or 4 cusps
- Sometimes the distolingual cusp is absent
- Extremely prominent transverse ridge
- Less prominent oblique ridge
- H-shaped groove pattern and three fossae: central, mesial triangular and distal triangular
- Central groove connects the central pit with the mesial and distal pits

The crown of the primary mandibular first molar does not resemble any other crown in either dentition, as well.

Primary Maxillary 2nd Molar

- Larger than primary maxillary 1st molar
- Most closely resembles a permanent maxillary first molar but is smaller in all dimensions
- May also have a *cusp of Carabelli*

Primary Mandibular 1st Molar

- Does not have a prominent buccal ridge
- Mesiolingual cusp is long, pointed, and angled which makes it stand out

Primary Mandibular 2nd Molar

- Larger than primary mandibular 1st molar
- Most closely resembles a permanent mandibular 1st molar
- Has 5 cusps

Name: _____

Class: _____

Dental Morphology Presentation Guide

Directions: Complete the following information as you listen to the Lesson 2 presentation.

Overview of Dentitions

Anterior teeth include _____ and _____. Posterior teeth include _____ and _____. Succedaneous teeth have / do not have (Circle One) primary predecessors. Nonsuccedaneous teeth have / do not have (Circle One) primary predecessors.

The three dentition periods are the _____ dentition, the _____ dentition, and the _____ dentition.

Aggressive periodontitis/juvenile periodontitis is:

Tooth Numbering

Universal Numbering System (UNS):

- Most widely used in the U.S.
- Designated in consecutive arrangement
- Primary = ____ through ____
- Permanent = ____ through ____
- Also used when charting restorations or periodontal conditions

International Numbering Systems (INS):

- First digit indicates the _____:
 - Digits 1-4 for permanent dentition
 - Digits 5-8 for primary dentition
- Second digit indicates the tooth's _____ in the quadrant:
 - Digits 1-8 used for permanent teeth
 - Digits 1-5 used for primary teeth

Palmer Notation Method:

- Most used in orthodontics
- Produces easy-to-navigate graphic mapping of dentition
- Teeth designated with a _____

Tooth Designation

Occlusion is the method by which the teeth of the maxillary arch meet the teeth of the mandibular arch. It can also be used to describe the anatomic alignment of the teeth and the relationship to the rest of the masticatory system. Teeth can be described by their position in each dental arch and their relationship to the midline as well. D-A-Q-T System is a system used to designate teeth:

D for _____

A for _____

Q for _____

T for _____

Tooth Anatomy Terms

The part of the crown covered by enamel is the: anatomic crown / clinical crown (Circle One)

The part of the anatomic crown that is visible in the oral cavity and is not covered by gingival tissue is the: anatomic crown / clinical crown (Circle One)

The part of the root covered by cementum is the: anatomic root / clinical root (Circle One)

The part of the anatomic root visible in the oral cavity and not covered by gingival tissue is the: anatomic root / clinical root (Circle One)

Masticatory Surfaces

The masticatory surface for anterior teeth is the: _____ surface

The masticatory surface for posterior teeth is the: _____ surface

The masticatory surface for anterior teeth is the: _____ surface

_____ are linear elevations on masticatory surfaces of either anterior or posterior teeth.

_____ are one or more elevations on the masticatory surface of the canine and posterior teeth.

Embrasures and Interproximal Spaces

Interproximal space is:

_____.

Embrasures are:

Embrasures:

- Form _____ between teeth to direct food away from the gingiva
- Provide a mechanism for teeth to be more _____
- Protect gingiva from undue _____ but still provide the proper degree of stimulation to the tissue

Tooth Functions

The teeth that bite and cut food: _____

The teeth that pierce and tear food: _____

The teeth that grind food: _____

Which teeth act as assistance to the functions of other teeth? _____

Occlusion

Centric occlusion is the voluntary position of the dentition that allows maximal contact when teeth occlude. It is also known as _____ occlusion. Centric occlusion is the centered contact position of the occlusal surfaces of mandibular teeth on the occlusal surface of the maxillary teeth. When teeth are in CO, each tooth of one arch is in occlusion with two others in the opposite arch.

When the maxillary arch horizontally overlaps the mandibular arch, it is called: overjet / overbite

When the maxillary arch vertically overlaps the mandibular arch, it is called: overjet / overbite

The _____ side is the side to which the mandible has been moved during lateral occlusion.

The _____ side is the other side of the arch (also known as the nonworking side).

When the teeth are in contact on the balancing side during lateral occlusion, it is known as _____.

_____ is when the entire posterior quadrant functions during lateral occlusion.

Resting posture is:

Interocclusal clearance is the space between dental arches when the mandible is at rest. It is also known as _____.

Primary Occlusion

Terminal plane is the ideal molar relationship in the primary dentition when in centric occlusion. The terminal plane relationship where the primary maxillary and mandibular second molars are in an end-to-end relationship is a _____. The terminal plane relationship where the primary mandibular second molar is mesial to the maxillary molar is a _____. No terminal plane relationship exists with a _____, because the primary mandibular second molar is distal to the maxillary second molar.

Which of these are *not* ideal? _____

Occlusal Disharmony and Malocclusion

Occlusal disharmony results from malalignment, orofacial myofunctional imbalances, and/or parafunctional habit patterns. Teeth may lose _____, and ability to _____, while also resulting in unnatural _____.

Malocclusion is the failure to have an overall ideal form to the dentition while in centric occlusion (CO). Angle classification of malocclusion is a system used to initially classify malocclusion. It is divided into 3 classes:

Class I Malocclusion

- Malocclusion characterized by ideal mesiodistal relationship of jaws and dental arches with minor dental malalignments
- Due to _____ or _____ within the jaws
- Facial profile in centric occlusion with slightly protruded jaws, giving facial outline a relatively flat appearance or straight profile is called _____
- The mesiobuccal cusp of the maxillary first molar _____ with the mesiobuccal groove of the mandibular first molar

Class II Malocclusion

- Malocclusion with the mesiobuccal cusp of the maxillary first molar occluding by more than the width of a premolar mesial to the mesiobuccal groove of the mandibular first molar
- Facial profile with protruding upper lip with recessive mandible and chin and convex profile is called _____

Class III Malocclusion

- Malocclusion with the mesiobuccal cusp of maxillary first molar occluding by more than width of a premolar distal to mesiobuccal groove of mandibular first molar
- Facial profile with rather prominent mandible and possibly normal or even retrusive maxilla, or concave profile is called _____

Other Malocclusions

The malocclusion that occurs due to the anterior teeth of both dental arches not occluding is known as:

Open bite / Crossbite / End-to-end bite (Circle One)

The malocclusion that occurs when the teeth occlude without the maxillary teeth overlapping mandibular teeth:

Open bite / Crossbite / End-to-end bite (Circle One)

The malocclusion that occurs when the mandibular tooth/teeth are placed facially to the maxillary tooth/teeth:

Open bite / Crossbite / End-to-end bite (Circle One)

Parafunctional Habits

Parafunctional habits are mandible movements not within normal motions associated with mastication, speech, or respiratory movements. _____ is a parafunctional habit where the teeth are held in centric occlusion for long periods of time without mandibular rest or interocclusal clearance.

_____ is the parafunctional habit of tooth grinding (forceful meshing of the teeth). This can lead to _____, _____, and enlarged masseter muscles.

_____ is the hard tooth tissue loss caused by tooth-to-tooth contact during mastication or parafunctional habits. This can lead to _____ or _____.

_____ is the inferiorly placed margin of the free gingival crest. _____ is hard tooth tissue loss from tensile and compressive forces during tooth flexure, shearing or flaking of the enamel surface.

_____ is the incorrect patterning during tongue function resulting in this parafunctional habit. _____ is a

parafunctional habit that includes digit and pacifier use past the age of 2. _____

_____ is the term used when the mouth is open, and the lips are apart as resting posture.

Permanent Teeth

Shallow, wide depression(s) on the lingual surface of the anterior teeth or the occlusal table of the posterior teeth are known as _____. Pits on the lingual surface of the anterior teeth or on the occlusal table and buccal, and lingual surface of the posterior teeth are known as _____.

_____ A primary groove that marks the junction among developmental lobes on the lingual surface of the anterior teeth or occlusal table of the posterior teeth are known as _____. A secondary groove on the lingual surface of the anterior teeth and the occlusal table on the posterior teeth are known as _____.

Permanent Anterior Teeth

Permanent anterior teeth have important anatomical features including:

- Depressions called _____
- Linear elevations on the incisal or masticatory surface of incisors when newly erupted, called _____
- A feature specific to anterior teeth that is a raised and rounded area on the cervical third of the lingual surface on the anterior teeth called a _____
- Another feature specific to anterior teeth are rounded enamel extensions on the incisal ridge of the anterior teeth called _____
- Permanent incisors have two _____ formed from incisal ridges or an edge and each proximal surface
- An _____ is a flattened incisal ridge on permanent incisors due to attrition after eruption

Hutchinson incisors are a:

Which are the most prominent teeth in the permanent dentition? _____

Which teeth have the greatest degree of variation in the permanent dentition? _____

Which are the smallest teeth in the permanent dentition? _____

Which teeth are also known as *eyeteeth*? _____

Which teeth are the most stable in the dentition with the longest root providing stability and anchorage to the rest of the dentition? _____

Complete tooth displacement from the socket due to extensive trauma is called _____.

Pulpal pathology may occur in a tooth even if only fractured, which may result in the need for endodontic treatment to avoid loss of tooth vitality. An open contact that can exist between permanent maxillary central incisors is called a _____. A _____ is a supernumerary tooth between two permanent maxillary central incisors.

A lateral incisor crown that is smaller due to partial microdontia is known as a _____ lateral.

Canines

- A tip of a cusp on the incisal surface of the canine teeth and occlusal table of the posterior teeth is known as a _____
- Two ridges on the incisal edge of the canine teeth divided by a cusp tip are known as _____

- A central ridge on the labial surface of canines from a greater development of the middle labial developmental lobe is known as a _____ ridge
- A vertically oriented and centrally placed ridge that extends from a cusp tip to the cingulum on the lingual surface of the canine teeth is known as a _____ ridge
- A canine tooth may not have enough space to erupt at first, so they tend to erupt labially or lingually to surrounding teeth. They sometimes remain unerupted or partially erupted positioned against another tooth, bone, or soft tissue preventing eruption, and it is known as _____.

Permanent Posterior Teeth

Permanent posterior teeth have important anatomical features including:

- The part of the occlusal surface of the posterior teeth bordered by marginal ridges is known as the _____
- _____ are cusp ridges that descend from the cusp tips toward the central part of occlusal table
- This type of ridge is formed by the joining of two triangular ridges crossing the occlusal table transversely: _____
- A fossa located at the convergence of cusp ridges in a central point is known as a _____
- A fossa that has a triangular shape where the triangular grooves terminates: _____
- Sharp, pinpoint depressions in fossae on the occlusal table of the posterior teeth are known as: _____
- The _____ is the most prominent developmental groove on the posterior teeth
- _____ are developmental grooves that cross either marginal ridge
- _____ are grooves that separate a marginal ridge from the triangular ridge of a cusp and form a triangular fossa at the termination of the ridges

Root Variations

Multirrooted teeth present with two or more root branches. The root trunk is at the root of multirrooted teeth where the root originates from the crown. A tooth having two root branches is _____. A tooth having three root branches is _____. The area between two or more root branches before division from the root trunk is the _____.

Other Important Ridges

Premolars have a prominent centrally located vertical _____ ridge.

Permanent molars have a ridge running mesiodistally in the cervical 1/3 of the buccal crown surface known as a _____ ridge.

They also have a _____ ridge that crosses the occlusal table obliquely from the mesiolingual to the distobuccal surface on most maxillary molars.

Variations of Molars

What is the small cusp sometimes present on the permanent maxillary first and second molar called? _____ of _____

What is the developmental disturbance that results from congenital syphilis that forms enamel nodules on the molars' occlusal surfaces known as? _____ molars

Clinical Consideration for Primary Teeth

What is the condition called involving extensive acute caries of the primary teeth? _____
_____ Caries

Dental Morphology Presentation Guide – Answer Key

Overview of Dentitions

Anterior teeth include **incisors** and **canines**. Posterior teeth include **premolars** and **molars**. Succedaneous teeth **have** / do not have (Circle One) primary predecessors. Nonsuccedaneous teeth **have** / **do not have** (Circle One) primary predecessors.

The three dentition periods are the **primary** dentition, the **mixed** dentition, and the **permanent** dentition.

Aggressive periodontitis/juvenile periodontitis is: **a condition in which evidence of bone loss is consistent around newly erupted permanent first molars and mandibular anteriors.**

Tooth Numbering

Universal Numbering System (UNS):

- Most widely used in the U.S.
- Designated in consecutive arrangement
- Primary = **A** through **T**
- Permanent = **1** through **32**
- Also used when charting restorations or periodontal conditions

International Numbering Systems (INS):

- First digit indicates the **quadrant**:
 - Digits 1-4 for permanent dentition
 - Digits 5-8 for primary dentition
- Second digit indicates the tooth's **position** in the quadrant:
 - Digits 1-8 used for permanent teeth
 - Digits 1-5 used for primary teeth

Palmer Notation Method:

- Most used in orthodontics
- Produces easy-to-navigate graphic mapping of dentition
- Teeth designated with **right-angle symbol**

Tooth Designation

Occlusion is the method by which the teeth of the maxillary arch meet the teeth of the mandibular arch. It can also be used to describe the anatomic alignment of the teeth and the relationship to the rest of the masticatory system. Teeth can be described by their position in each dental arch and their relationship to the midline as well. D-A-Q-T System is a system used to designate teeth:

D for **Dentition**

A for **Arch**

Q for **Quadrant**

T for **Tooth type**

Tooth Anatomy Terms

The part of the crown covered by enamel is the: **anatomic crown** / clinical crown (Circle One)

The part of the anatomic crown that is visible in the oral cavity and is not covered by gingival tissue is the: anatomic crown / **clinical crown** (Circle One)

The part of the root covered by cementum is the: **anatomic root** / clinical root (Circle One)

The part of the anatomic root visible in the oral cavity and not covered by gingival tissue is the: anatomic root / **clinical root** (Circle One)

Masticatory Surfaces

The masticatory surface for anterior teeth is the: **incisal** surface

The masticatory surface for posterior teeth is the: **occlusal** surface

Ridges are linear elevations on masticatory surfaces of either anterior or posterior teeth.

Cusps are one or more elevations on the masticatory surface of the canine and posterior teeth.

Embrasures and Interproximal Spaces

Interproximal space is:

the area between adjacent tooth surfaces.

Embrasures are:

triangle-shaped spaces from curvatures where two teeth in same arch contact.

Embrasures:

- Form **spillways** between teeth to direct food away from the gingiva
- Provide a mechanism for teeth to be more **self-cleansing**
- Protect gingiva from undue **frictional trauma** but still provide the proper degree of stimulation to the tissue

Tooth Functions

The teeth that bite and cut food: **incisors**

The teeth that pierce and tear food: **canines**

The teeth that grind food: **molars**

Which teeth act as assistance to the functions of other teeth? **premolars**

Occlusion

Centric occlusion is the voluntary position of the dentition that allows maximal contact when teeth occlude. It is also known as **habitual** occlusion. Centric occlusion is the centered contact position of the occlusal surfaces of mandibular teeth on the occlusal surface of the maxillary teeth. When teeth are in CO, each tooth of one arch is in occlusion with two others in the opposite arch.

When the maxillary arch horizontally overlaps the mandibular arch, it is called: **overjet** / overbite

When the maxillary arch vertically overlaps the mandibular arch, it is called: overjet / **overbite**

The **working** side is the side to which the mandible has been moved during lateral occlusion.

The **balancing** side is the other side of the arch (also known as the nonworking side).

When the teeth are in contact on the balancing side during lateral occlusion, it is known as **balancing interference**.

Group function is when the entire posterior quadrant functions during lateral occlusion.

Resting posture is:

the normal physiologic position of tongue, lips, and mandible when not in function of chewing, swallowing, or speech.

Interocclusal clearance is the space between dental arches when the mandible is at rest. It is also known as **freeway space**.

Primary Occlusion

Terminal plane is the ideal molar relationship in the primary dentition when in centric occlusion. The terminal plane relationship where the primary maxillary and mandibular second molars are in an end-to-end

relationship is a **flush terminal plane**. The terminal plane relationship where the primary mandibular second molar is mesial to the maxillary molar is a **mesial step**. No terminal plane relationship exists with a **distal step**, because the primary mandibular second molar is distal to the maxillary second molar.

Which of these are *not* ideal? **distal step**

Occlusal Disharmony and Malocclusion

Occlusal disharmony results from malalignment, orofacial myofunctional imbalances, and/or parafunctional habit patterns. Teeth may lose **proper function**, and ability to **self-cleanse**, while also resulting in unnatural **occlusal stress**.

Malocclusion is the failure to have an overall ideal form to the dentition while in centric occlusion (CO). Angle classification of malocclusion is a system used to initially classify malocclusion. It is divided into 3 classes:

Class I Malocclusion

- Malocclusion characterized by ideal mesiodistal relationship of jaws and dental arches with minor dental malalignments
- Due to **crowding** or **irregular spaces** within the jaws
- Facial profile in centric occlusion with slightly protruded jaws, giving facial outline a relatively flat appearance or straight profile is called **mesognathic**
- The mesiobuccal cusp of the maxillary first molar **occludes** with the mesiobuccal groove of the mandibular first molar

Class II Malocclusion

- Malocclusion with the mesiobuccal cusp of the maxillary first molar occluding by more than the width of a premolar mesial to the mesiobuccal groove of the mandibular first molar
- Facial profile with protruding upper lip with recessive mandible and chin and convex profile is called **retrognathic**

Class III Malocclusion

- Malocclusion with the mesiobuccal cusp of maxillary first molar occluding by more than width of a premolar distal to mesiobuccal groove of mandibular first molar
- Facial profile with rather prominent mandible and possibly normal or even retrusive maxilla, or concave profile is called **prognathic**

Other Malocclusions

The malocclusion that occurs due to the anterior teeth of both dental arches not occluding is known as:

Open bite / Crossbite / End-to-end bite (Circle One)

The malocclusion that occurs when the teeth occlude without the maxillary teeth overlapping mandibular teeth:

Open bite / Crossbite / **End-to-end bite** (Circle One)

The malocclusion that occurs when the mandibular tooth/teeth are placed facially to the maxillary tooth/teeth:

Open bite / **Crossbite** / End-to-end bite (Circle One)

Parafunctional Habits

Parafunctional habits are mandible movements not within normal motions associated with mastication, speech, or respiratory movements. **Clenching** is a parafunctional habit where the teeth are held in centric occlusion for long periods of time without mandibular rest or interocclusal clearance. **Bruxism** is the parafunctional habit of tooth grinding (forceful meshing of the teeth). This can lead to **attrition**, **wear facets**, and enlarged masseter muscles. **Attrition** is the hard tooth tissue loss caused by tooth-to-tooth contact during mastication or parafunctional habits. This can lead to **gingival recession** or **abfraction**. **Gingival recession** is the inferiorly placed margin of the free gingival crest. **Abfraction** is hard tooth tissue loss from tensile and compressive forces during tooth flexure, shearing or flaking of the enamel surface.

Tongue thrust is the incorrect patterning during tongue function resulting in this parafunctional habit. **Retained sucking habit** is a parafunctional habit that includes digit and pacifier use past the age of 2. **Lip incompetence** is the term used when the mouth is open, and the lips are apart as resting posture.

Permanent Teeth

Shallow, wide depression(s) on the lingual surface of the anterior teeth or the occlusal table of the posterior teeth are known as **fossae**. Pits on the lingual surface of the anterior teeth or on the occlusal table and buccal, and lingual surface of the posterior teeth are known as **developmental pits**. A primary groove that marks the junction among developmental lobes on the lingual surface of the anterior teeth or occlusal table of the posterior teeth are known as **developmental grooves**. A secondary groove on the lingual surface of the anterior teeth and the occlusal table on the posterior teeth are known as **supplemental grooves**.

Permanent Anterior Teeth

Permanent anterior teeth have important anatomical features including:

- Depressions called **developmental depressions**
- Linear elevations on the incisal or masticatory surface of incisors when newly erupted, called **incisal ridges**
- A feature specific to anterior teeth that is a raised and rounded area on the cervical third of the lingual surface on the anterior teeth called a **cingulum**
- Another feature specific to anterior teeth are rounded enamel extensions on the incisal ridge of the anterior teeth called **mamelons**
- Permanent incisors have two **incisal angles** formed from incisal ridges or an edge and each proximal surface
- An **incisal edge** is a flattened incisal ridge on permanent incisors due to attrition after eruption

Hutchinson incisors are a:

developmental disturbance in permanent incisors with screwdriver-shaped crowns caused by congenital syphilis

Which are the most prominent teeth in the permanent dentition? **Maxillary centrals**

Which teeth have the greatest degree of variation in the permanent dentition? **Maxillary laterals**

Which are the smallest teeth in the permanent dentition? **Mandibular centrals**

Which teeth are also known as *eyeteeth*? **Canines**

Which teeth are the most stable in the dentition with the longest root providing stability and anchorage to the rest of the dentition? **Canines**

Complete tooth displacement from the socket due to extensive trauma is called **avulsion**. Pulpal pathology may occur in a tooth even if only fractured, which may result in the need for endodontic treatment to avoid loss of tooth vitality. An open contact that can exist between permanent maxillary central incisors is called a **diastema**. A **mesiodens** is a supernumerary tooth between two permanent maxillary central incisors.

A lateral incisor crown that is smaller due to partial microdontia is known as a **peg** lateral.

Canines

- A tip of a cusp on the incisal surface of the canine teeth and occlusal table of the posterior teeth is known as a **cusp tip**
- Two ridges on the incisal edge of the canine teeth divided by a cusp tip are known as **cusp slopes**
- A central ridge on the labial surface of canines from a greater development of the middle labial developmental lobe is known as a **labial** ridge
- A vertically oriented and centrally placed ridge that extends from a cusp tip to the cingulum on the lingual surface of the canine teeth is known as a **lingual** ridge
- A canine tooth may not have enough space to erupt at first, so they tend to erupt labially or lingually to surrounding teeth. They sometimes remain unerupted or partially erupted positioned against another tooth, bone, or soft tissue preventing eruption and it is known as **impaction**.

Permanent Posterior Teeth

Permanent posterior teeth have important anatomical features including:

- The part of the occlusal surface of the posterior teeth bordered by marginal ridges is known as the **occlusal table**
- **Triangular ridges** are cusp ridges that descend from the cusp tips toward the central part of occlusal table
- This type of ridge is formed by the joining of two triangular ridges crossing the occlusal table transversely: **transverse ridge**
- A fossa located at the convergence of cusp ridges in a central point is known as a **central fossa**

- A fossa that has a triangular shape where the triangular grooves terminates: **triangular fossa**
- Sharp, pinpoint depressions in fossae on the occlusal table of the posterior teeth are known as: **occlusal pits**
- The **central groove** is the most prominent developmental groove on the posterior teeth
- **Marginal grooves** are developmental grooves that cross either marginal ridge
- **Triangular grooves** are grooves that separate a marginal ridge from the triangular ridge of a cusp and form a triangular fossa at the termination of the ridges

Root Variations

Multirooted teeth present with two or more root branches. The root trunk is at the root of multirooted teeth where the root originates from the crown. A tooth having two root branches is **bifurcated**. A tooth having three root branches is **trifurcated**. The area between two or more root branches before division from the root trunk is the **furcation**.

Other Important Ridges

Premolars have a prominent centrally located vertical **buccal** ridge.

Permanent molars have a ridge running mesiodistally in the cervical 1/3 of the buccal crown surface known as a **cervical** ridge.

They also have a(n) **oblique** ridge that crosses the occlusal table obliquely from the mesiolingual to the distobuccal surface on most maxillary molars.

Variations of Molars

What is the small cusp sometimes present on the permanent maxillary first and second molar called? **Cusp of Carabelli**.

What is the developmental disturbance that results from congenital syphilis that forms enamel nodules on the molars' occlusal surface known as? **Mulberry** molars

Clinical Consideration for Primary Teeth

What is the condition called involving extensive acute caries of the primary teeth? **Early Childhood** Caries

Lesson Two – Dental Morphology

REVIEW: Identification and Assessment of Tooth Anatomy and Morphology

20-30 minutes

Purpose:

Participants will apply the knowledge learned in the lecture. They will identify various anatomic structures on the provided models using the vocabulary flashcards.

Materials:

- Vocabulary flashcards
- Anatomical Models
- *Dental Morphology Quiz*
- *Dental Morphology Quiz – Answer Key*

Facilitation Steps:

1. Using their flashcards, have participants review the vocabulary words.
2. Have participants get in a group and quiz each other on the structures and their definitions.
3. To integrate the use of the Dental Morphology models, have the paired-up students rotate around the tables where the models are set up in stations again as in the FOCUS section. This time they will use what they learned in the lesson to identify the different structures/landmarks on the models.
4. Organize the flashcards so that the correct ones are at each table to match each model.
5. Have the paired-up participants point out each structure using the flashcards with the names listed.

Station 1 – Removable Child Dentition Model (20 removable teeth)

Station 2 – Standard tooth Model (32 teeth)

Station 3 – Dentural Development Model 3-6 Years Old

Station 4 – Dentural Development Model 5-9 Years Old

Station 5 – Dentural Development Model 9-12 Years Old
6. Have participants mix the flashcards back up before they rotate to the next station, giving each group a chance to correctly match the flashcards to the structures on the models.
7. When participants are finished at each station, instruct them to take a few minutes to complete the quiz.
8. Have participants self-check their answers as you share from the answer key.

Name: _____ Class: _____

Dental Morphology Quiz

Directions: Select the best answer to the following multiple-choice questions.

1. Which specialty of dentistry is the Palmer Notation Method most used in?
 - a. Orthodontics
 - b. Periodontics
 - c. Endodontics
 - d. Oral Surgery
2. True or False: Every permanent tooth replaces the same primary tooth.
3. What is the term for when the maxillary arch horizontally overlaps the mandibular arch by about 1-3 mm?
 - a. Overbite
 - b. Overjet
 - c. Underbite
 - d. Crossbite
4. True or False: Distal step is the ideal relationship for primary occlusion.
5. Which of the following parafunctional habits affect malocclusion of the jaws?
 - a. Clenching
 - b. Tongue thrust
 - c. Lip incompetence
 - d. Abfraction
 - e. All the above
6. Hutchinson incisors and mulberry molars are a developmental disturbance caused by which disease?
 - a. Congenital heart disease
 - b. Psoriasis
 - c. Fetal alcohol syndrome
 - d. Congenital syphilis
7. Which teeth have the longest root in the maxillary arch?
 - a. Maxillary canines
 - b. Maxillary third molars
 - c. Maxillary incisors
 - d. Maxillary first molars
8. What action can lead to early childhood caries (ECC)?
 - a. Not taking a child to the dentist by age 1
 - b. Prolonged nighttime use of a baby bottle with a cavity-causing beverage or from sugar on a pacifier
 - c. Wiping their mouth out with a damp cloth after feeding
 - d. Thumb sucking

Dental Morphology Quiz– Answer Key

1. Which specialty of dentistry is the Palmer Notation Method most used in?
 - a. **Orthodontics**
 - b. Periodontics
 - c. Endodontics
 - d. Oral Surgery
2. True or **False**: Every permanent tooth replaces the same primary tooth.
3. What is the term for when the maxillary arch horizontally overlaps the mandibular arch by about 1-3 mm?
 - a. Overbite
 - b. **Overjet**
 - c. Underbite
 - d. Crossbite
4. True or **False**: Distal step is the ideal relationship for primary occlusion.
5. Which of the following parafunctional habits affect malocclusion of the jaws?
 - a. Clenching
 - b. Tongue thrust
 - c. Lip incompetence
 - d. Abfraction
 - e. **All the above**
6. Hutchinson incisors and Mulberry molars are a developmental disturbance caused by which disease?
 - a. Congenital heart disease
 - b. Psoriasis
 - c. Fetal alcohol syndrome
 - d. **Congenital syphilis**
7. Which teeth have the longest root in the maxillary arch?
 - a. **Maxillary canines**
 - b. Maxillary third molars
 - c. Maxillary incisors
 - d. Maxillary first molars
8. What action can lead to early childhood caries (ECC)?
 - a. Not taking a child to the dentist by age 1
 - b. **Prolonged nighttime use of a baby bottle with a cavity-causing beverage or from sugar on a pacifier**
 - c. Wiping their mouth out with a damp cloth after feeding
 - d. Thumb sucking

Lesson Three – Dental Pathology

Lesson Overview

In this lesson, participants will learn to identify anatomical anomalies that may be present within the oral cavity, as well as recognize the various instances of oral pathology.

Lesson Objectives

After completing this lesson, participants will be able to:

- Identify anatomical anomalies
- Recognize instances of oral pathology

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• Anatomical Models	1. Set out models for Dental Anatomy content: Adult Pathologies Model, Pediatric Pathologies Model, Periodontal Diseases Classification Model, and Six Times Caries Anatomy Model.	10 minutes
LEARN	• <i>Dental Pathology</i> slide presentation • <i>Dental Pathology Presentation Guide</i> • <i>Dental Pathology Presentation Guide – Answer Key</i>	1. Prepare the <i>Dental Pathology</i> slide presentation for viewing. 2. Print the <i>Dental Pathology Presentation Guide</i> (one per participant). 3. Make the <i>Dental Pathology Presentation Guide – Answer Key</i> available.	45 minutes
REVIEW	• Vocabulary flashcards • Anatomical Models • <i>Dental Pathology Quiz</i> • <i>Dental Pathology Quiz – Answer Key</i>	1. Transfer the vocabulary list onto printable flashcards. 2. Print vocabulary flashcards. 3. Print the <i>Dental Pathology Quiz</i> (one per participant).	20-30 minutes

Instructor Note: Focus activities should tie into review. Have students examine models at the beginning of the lesson and then try to identify landmarks from the vocabulary flashcards on the models during the review.

Lesson Three – Dental Pathology

FOCUS: Getting Familiar with Instances of Pathology on the Models

10 minutes

Purpose:

Participants work in groups to examine the models used for this content, getting familiar with different variations of normal and testing what they are already able to identify.

Materials:

- Adult Pathologies Model
- Pediatric Pathologies Model
- Periodontal Diseases Classification Model
- Six Times Caries Anatomy Model

Facilitation Steps:

1. Set the models out on various tables before or at the beginning of class.
2. Divide participants into groups to move around each table to examine each model.
3. Have participants attempt to identify various pathologies on each model. Participants should spend two minutes at each table as this is just to test what they may already know and familiarize themselves with what each instance looks like.

Lesson Three – Dental Pathology

LEARN: Dental Pathology Lecture

45 minutes

Purpose:

Participants will receive a thorough introduction to various anatomical anomalies as well as basic terms related to pathology in the body, with a focus on the most common instances of oral pathology, oral manifestations, signs and symptoms for each condition, and clinical considerations for each condition.

Materials:

- *Dental Pathology* slide presentation
- *Dental Pathology Presentation Guide*
- *Dental Pathology Presentation Guide – Answer Key*

Facilitation Steps:

Share the following information as you show the slide presentation. Give each participant the *Dental Pathology Presentation Guide* for notetaking during the presentation.

Slide 1: Introduction slide

Slide 2: Goals and Objectives

- Identify anatomical anomalies of the oral cavity
- Recognize instances of oral pathology

Slides 3-13: Dental Anomalies

Anomaly: something that deviates from what is standard or normal

Anodontia: absence of single tooth or multiple teeth (partial or complete anodontia)

- Etiologic factors: hereditary, endocrine dysfunction, systemic disease, excess radiation exposure that prevents tooth formation
- Clinical ramifications: Disruption of occlusion and aesthetic complications

Commonly include permanent third molars, maxillary lateral incisors, or the second premolar in a dental arch.

*Use Pediatric Pathologies Model.

Supernumerary teeth: development of one or more extra teeth

- Etiologic factors: hereditary
- Clinical ramifications: crowding, disruption of occlusion, and failure of eruption of other teeth

Supernumerary roots: more than the normal number of roots

- Etiologic factors: unknown, but believed to be from external pressure, trauma, or metabolic dysfunction during root development

Supernumerary teeth are commonly found between the permanent maxillary central incisors (mesiodens), distal to the third molar (distomolar), and in the premolar region (perimolar). Mandibular bicuspid and cuspids are most affected with supernumerary roots.

Microdontia/macrodontia: abnormally small or large teeth (partial or complete)

- Etiologic factors: hereditary with partial, endocrine dysfunction with complete
- Clinical ramifications: spacing and aesthetic complications

Commonly affect permanent maxillary lateral incisors and third molars. The image in slide 5 displays macrodontia.

Dens in dente: developmental disturbance caused by invagination of enamel organ into dental papilla

- Etiologic factors: hereditary
- Clinical ramifications: deep lingual pit

Tubercle: small, rounded enamel extensions forming extra cusps

- Etiologic factors: trauma, pressure, or a metabolic disease that affects enamel organs

- Clinical ramifications: occlusal complications

The anomaly dens in dente commonly affects the permanent maxillary lateral incisors. Tubercles are commonly found on permanent posterior occlusal surfaces or on permanent anterior lingual surfaces. The image on slide 6 shows a tooth presenting with dens in dente.

Gemination: when a single tooth germ tries to divide and develops large, single-rooted tooth with one pulp cavity and “twinning”

- Etiologic factors: hereditary
- Clinical ramifications: spacing and aesthetic complications

Fusion: union of two adjacent tooth germs that result in a large tooth with two pulp cavities and one fewer tooth in the dentition

- Etiologic factors: pressure
- Clinical ramifications: spacing and aesthetic complications

Gemination commonly occurs in the crown of anteriors with a correct number of teeth present in a dentition. Fusion commonly occurs in anteriors in the primary dentition and leads to one fewer tooth in a dentition.

Concrescence: union of root structure of two or more teeth by cementum

- Etiologic factors: crowding of teeth or traumatic injury
- Clinical ramifications: endodontic complications or extraction complications

Dilaceration: an abnormal bend or curve in the root of a tooth

Concrescence commonly affects permanent maxillary molars. The image in slide 8 is of a dilacerated root.

Talon cusp: an accessory cusp located in the cingulum of a maxillary or mandibular permanent incisor

- Clinical ramifications: removal is often necessary because it interferes with occlusion

Taurodontism: a condition characterized by very large, pyramid-shaped molars with large pulp chambers and short root

Turner tooth: a permanent tooth showing enamel hypoplasia resulting from infection or trauma to the deciduous teeth

- Color of enamel may range from yellow to brown
- Severe pitting or deformity may be present

A talon cusp is most common on the maxillary lateral incisors. Taurodontism usually affects molars. It can be unilateral or bilateral. The crown of the tooth appears clinically normal. A Turner tooth commonly affects permanent premolars.

Enamel dysplasia: faulty enamel development from interference involving ameloblasts (cells that create enamel) that results in enamel hypoplasia (enamel pitting) and/or enamel hypocalcification (intrinsic color changes) with possible changes in enamel thickness

- Etiologic factors: local or systemic from traumatic birth, systemic infections, dental fluorosis, or nutritional deficiencies
- Clinical ramifications: spacing and aesthetic complications

Dental fluorosis: a condition resulting from the ingestion of high concentrations of fluoride, causing the affected teeth to have a mottled discoloration of the enamel

- Clinical ramifications: generally decay resistant; bleaching, bonding, composites, porcelain veneers, or full-coverage crowns may be used to improve aesthetic appearance

Intrinsic staining of the teeth: occurs as a result of the deposition of substances circulating systemically during tooth development

- i.e., ingestion of tetracycline causes a yellowish-green discoloration of dentin that is visible through the enamel

The more fluoride ingested, the more severe the mottling.

Enamel hypoplasia: the incomplete or defective formation of enamel, resulting in the alteration of tooth form or color

Enamel hypocalcification: a developmental anomaly that results in a disturbance of the maturation of the enamel matrix

Enamel pearl: enamel sphere on root

- Etiologic factors: displacement of ameloblasts to root surface
- Clinical ramifications: confused as calculus deposit on root

Enamel hypocalcification usually appears as a localized, chalky white spot on the middle third or smooth crowns, and the underlying enamel may be soft and susceptible to caries.

Pictured in slide 12 is an enamel pearl seen on an extracted tooth.

Amelogenesis imperfecta: a broad group of conditions that affect the structural formation of enamel

Dentinogenesis imperfecta: a disturbance of the dentin of genetic origin

- Characterized by early calcification of the pulp chambers and root canals, marked attrition, and an opalescent hue to the teeth
- Etiologic factors: hereditary

Pictured on slide 13 is amelogenesis imperfecta.

Slides 14-16: Terms Used to Describe Lesions

Clinical Appearances of Soft Tissue Lesions

Bulla: a circumscribed, elevated lesion that is more than 5 mm in diameter, usually containing serous fluid, and looks like a blister

Lobule: a segment or lobe that is part of a whole; sometimes appear fused together

Macule: a flat area usually distinguished by a color different than that of surrounding tissue; does not protrude above the surface of normal tissue i.e. freckle

Papule: a small, circumscribed lesion usually less than 1 cm in diameter that is elevated and protrudes above the surface of surrounding tissue

Pedunculated: attached by a stem-like or stalk-like base (like that of a mushroom)

Pustules: variously sized circumscribed elevations containing pus

Sessile: base of a lesion that is flat or broad instead of stemlike

Vesicle: a small, elevated lesion less than 1 cm in diameter that contains serous fluid

*Use Adult Pathologies Model.

Soft Tissue Consistency

Nodule: a palpable, solid lesion up to 1 cm in diameter found in soft tissue; can occur above, level with, or beneath the skin surface

Color of Lesion

Erythema: abnormal redness of the mucosa or gingiva

Erythroplakia: a clinical term used to describe an oral mucosal lesion that appears as a smooth, red patch or granular, red, and velvety patch

Leukoplakia: a clinical term for a white, plaque-like lesion on the oral mucosa that cannot be rubbed off

Pallor: paleness of the skin or mucosal tissues

Size of Lesion

- Measured in centimeters or millimeters

The most frequent colors used to describe oral lesions are red, pink, salmon, white, blue-black, gray, brown, and black.

Surface Texture

Corrugated: wrinkled

Fissure: a cleft/groove

Papillary: resembling small, nipple-shaped projections or elevations; found in clusters

- Other terms used to describe surface texture of a lesion include smooth, rough, and folded.

The image on slide 16 displays a corrugated lesion on the buccal mucosa.

Slide 17: Radiographic Terms Used To Describe Lesions in Bone

Coalescence: the process by which parts of a whole join, or fuse, to make one

Diffuse: a lesion with borders that are not well defined, difficult to detect exact parameters

Multilocular: a lesion that extends beyond the confines of one distinct area that has many lobes or parts that are somewhat fused together, making up the entire lesion; resembles soap bubbles

Radiolucent: black or dark areas on a radiograph; radiant energy can pass through these structures

Radiolucent and radiopaque: a mixture of light and dark areas within a lesion

Radiopaque: light or white area on a radiograph; radiant energy is unable to pass through these structures

The denser the structure, the lighter or whiter it appears on a radiograph and vice versa.

Slides 18-19: Variants of Normal in the Soft Tissue and Tongue

Retrocuspid papilla: a sessile nodule on the gingival margin of the lingual aspect of the mandibular cuspids

Lingual varicosities: prominent lingual veins usually observed on the ventral and lateral surfaces of the tongue

Leukoedema: characterized by an opalescence of the buccal mucosa

Median rhomboid glossitis: a flat or slightly raised oval or rectangular erythematous area in the midline of the dorsal surface of the tongue devoid of filiform papillae

Erythema migrans/geographic tongue: lesion that appears as red and then paler pink to white patches on the tongue body

Median rhomboid glossitis begins at the junction of the anterior and middle thirds of the tongue and extends posterior to the circumvallate papillae.

Geographic tongue is pictured on slide 18.

Fissured tongue: characterized by the dorsal surface of the tongue having deep fissures or grooves

Black hairy tongue: tongue lesion marked by dead cells and keratin buildup that becomes extrinsically stained

Dysphagia: difficulty swallowing

Dysphonia: difficulty speaking

Dyspnea: difficulty breathing

Black hairy tongue may be an effect of fungal overgrowth, possibly from high doses of antibiotic or radiation therapy.

Slides 20-22: Inflammation and Repair

Necrosis: the pathologic death of one or more cells or a portion of a tissue or organ, resulting from irreversible damage

Inflammation: a nonspecific response to injury that may be local, systemic, acute, or chronic

Local: limited to the area of injury

Systemic: pertaining to or affecting the body as a whole

Acute: of short duration, minimal and brief

Chronic: persisting symptoms over a long period of time

Injury is the result of an alteration in the environment that causes tissue damage. Severe injury may result in necrosis.

Edema: localized swelling or enlargement of tissue due to excess plasma or exudate

Exudate: inflammatory fluid formed as a reaction to injury of tissues and blood vessels

Serous exudate: an exudate that has a watery consistency; a thin, clear fluid resembling serum

Purulent exudate: thick, white-to-yellow pus that contains tissue debris and many white blood cells, also known as *suppuration*

Abscess: a collection of purulent exudate that has accumulated in a contained space formed by the surrounding tissue

Fistula: formation of a drainage passage that bores through tissue, allowing drainage to the outside

A fistula is pictured on slide 21.

*Use Periodontal Diseases Classification Model.

Granuloma: a tumorlike mass of inflammatory tissue

- Destroys the surrounding tissue and tends to persist for a long time

Hypertrophy: an enlargement of a tissue or organ caused by an increase in the size of individual cells within the tissue, but not in the number of cells

- A response to cellular stress

Atrophy: the decrease in size and function of a cell, tissue, organ, or whole body

- A response to cellular stress

Granulation tissue: initial tissue formed in the connective tissue of an injury; immature tissue

Keloid: excessive skin scarring that appears raised and extends beyond its original boundaries

A keloid on the face is pictured on slide 22.

Slide 23: Oral Trauma

Meth-mouth: the extensive and rapid destruction of teeth due to methamphetamine use

Aspirin burn: a type of chemical injury that occurs when a patient places an aspirin tablet directly on mucosal tissue instead of swallowing it

Traumatic ulcer: an ulcer that occurs from some form of trauma most commonly to the lips, tongue, or buccal mucosa

Traumatic granuloma: a hard, raised, ulcerated lesion resulting from persistent trauma

Hematoma: a lesion that results from the accumulation of blood within tissue as a result of trauma

Traumatic neuroma: a lesion caused by injury to a peripheral nerve

A traumatic ulcer usually heals within 7-14 days. It may occur from cheek biting, lacerations from sharp edges of food, etc.

Slides 24-26: Various Oral Conditions

Amalgam tattoo: a flat, bluish-gray lesion of the oral mucosa resulting from the introduction of amalgam particles into the tissue

Solar or actinic cheilitis: degeneration of the tissue of the lips caused by sun exposure

Pyogenic granuloma: a benign, reacting, painless, commonly occurring intraoral lesion characterized by proliferation of connective tissue containing numerous blood vessels and inflammatory cells

Amalgam tattoos occur at the time of placement or removal of an amalgam restoration or at the time of tooth extraction if fragments of amalgam fracture off a restoration and remain on the tissue. They are most found on the gingiva or on an edentulous alveolar ridge. They're usually diagnosed based on clinical appearance of the pigmented area.

Fibroma: a broad-based, benign lesion composed of dense, scar-like connective tissue containing few blood cells

Frenal tag: a small, finger-like projection of hyperplastic fibrous tissue attached to the maxillary labial frenum

Gingival hyperplasia: enlargement of the gingiva

Periapical abscess: an abscess composed of pus and surrounded by connective tissue containing neutrophils and lymphocytes

Ludwig angina: a rapidly aggressive form of cellulitis; rare but very severe consequence of a dental infection

Periapical granuloma: a localized mass of chronically inflamed granulation tissue that forms at the opening of a pulp canal, generally at the apex of a nonvital tooth root

Fibromas occur because of chronic trauma.

Frenal tags are common and do not require removal.

Gingival hyperplasia is usually associated with local irritants, such as dental biofilm or calculus. It also results from hormonal changes, such as pregnancy, and is a side effect to some medications, such as calcium channel blockers.

A periapical abscess usually develops directly from inflammation in the pulpal tissue.

Ludwig angina involves massive swelling of the tissue of the floor of the mouth and neck, which can be life threatening by causing airway obstruction.

If a patient presents with a periapical granuloma, the tooth may appear slightly extruded from its socket. The PDL may appear thickened in the area affected on a radiograph.

The top picture is of a frenal tag. The bottom picture is of a periapical abscess seen on a radiograph.

Radicular cyst: a cyst attached to the root apex of a tooth with a necrotic pulp or a defective root canal filling

- A true cyst
- Located at apex of a nonvital tooth root

Residual cyst: a cyst that forms when a tooth is removed and all or part of a radicular cyst is left behind

Condensing osteitis: a change in bone near the apices of teeth

- Seen as a radiopacity

Alveolar osteitis or "dry socket": a postoperative complication of tooth extraction in which, after extraction, the blood clot breaks down and is lost before healing occurs

A radicular cyst is the most commonly occurring cyst in oral region.

Condensing osteitis (pictured in slide 26) is thought to be a reaction to a low-grade infection.

Slides 27-30: Oral Immunologic Lesions

Recurrent aphthous ulcers: (aka *canker sores*) painful oral ulcer of unknown cause; substantial evidence indicates that they have an immunologic pathogenesis

- Frequently occur in episodes
- Usually follow trauma to the oral mucosa

- Iron, folic acid, and B12 deficiencies associated with these ulcers
- Emotional stress also contributing factor

Erythema multiforme: an acute, self-limited disease that affects the skin and mucous membranes

- Usually triggered by drug exposure
- Ulcers frequently form on lateral surfaces of tongue
- Crusted and bleeding lips are other associated symptoms
- “*Target*” or “*Bull’s-eye*” lesion

The characteristic skin lesion is called a “*target*” or “*bull’s-eye*” lesion, which consists of concentric rings of erythema alternating with normal skin color, with the darkest color at the center of the lesion. The cause is unclear, but some evidence exists that it is a hypersensitivity reaction.

Lichen planus: a benign, chronic disease affecting the skin and oral mucosa

- Common characteristic is a lacelike pattern of interconnecting white lines and circles
- Most common location is buccal mucosa

Sjögren’s syndrome: an autoimmune disease that affects the salivary and lacrimal glands, resulting in a decrease in saliva and tears

- Keratoconjunctivitis (damage to eyes) associated with this condition

Systemic lupus erythematosus: an acute and chronic inflammatory autoimmune disease of unknown cause

- Predominantly affects women
- Chronic syndrome with periods of remission and exacerbation

Pemphigus vulgaris: a severe, progressive autoimmune disease that affects the skin and mucous membranes

Pictured on slide 30 is xerostomia as an effect of Sjögren’s Syndrome.

Slides 31-38: Infectious Diseases

Impetigo: an infectious bacterial infection causing primarily *Staphylococcus aureus* that most commonly involves lesions on the skin of the face or extremities

Scarlet fever: contagious childhood disease characterized by a red rash, strawberry tongue, sore throat, fever, and enlarged lymph nodes

Rheumatic fever: a childhood disease that follows a streptococcal infection, usually tonsilitis and pharyngitis characterized by an inflammatory reaction involving the heart, joints, and central nervous system

Areas of trauma such as cuts and abrasions and areas of dermatitis are sites of impetigo.

The fungiform papillae are red and prominent with the dorsal surface of the tongue exhibiting either a white coating or erythema with scarlet fever. Pictured on slide 31 is a child with scarlet fever presenting with a strawberry tongue.

Tuberculosis: an infectious chronic granulomatous disease usually caused by the organism *Mycobacterium tuberculosis*; primary infection of the lung

Actinomycosis: an infection caused by a filamentous bacterium called *Actinomyces israelii*

Syphilis: a disease caused by the spirochete *Treponema pallidum* usually transmitted through sexual contact with a partner with an active lesion, by blood, or transmission from a mother to a fetus through the placenta

- Primary: chancre = highly infectious
- Secondary: mucous patches = most infectious stage
- Tertiary: gumma = noninfectious

Congenital syphilis: the type of syphilis that is transmitted from an infected mother to the fetus

The most characteristic manifestation of actinomycosis is the formation of abscesses that drain through fistulas.

Syphilis occurs in three stages with three different corresponding lesions: chancre, mucous patches, and gumma. Pictured on slide 32 is a chancre in the primary stage of syphilis.

Necrotizing ulcerative gingivitis (NUG): a painful erythematous gingivitis with necrosis of the interdental papillae

- Presents with foul odor and metallic taste
- Presents with tissue sloughing

Pericoronitis: an inflammation of the mucosa around the crown of a partially erupted tooth

Verruca vulgaris: a common wart; a white, papillary lesion caused by a human papilloma virus

- The lips are one of the most common intraoral sites

NUG is pictured on slide 33.

Candidiasis: an overgrowth of the yeastlike fungus *Candida albicans*

- Most common oral fungal infection
- Can result from antibiotic use, cancer, corticosteroid therapy, dentures, diabetes mellitus, and HIV infection

Denture stomatitis: most common type of candidiasis affecting the oral mucosa due to irritation from denture

- Lesions may be petechiae-like to more generalized and granular

Denture stomatitis presents as erythematous mucosa, but the erythematous change is limited to the mucosa covered by a full or partial denture. Pictured in slide 34 is denture stomatitis.

*Use Six Times Caris Anatomy Model

Recurrent herpes simplex infection: herpes simplex virus that persists in a latent state and causes localized recurrent infections (usually produced by stimuli such as sunlight, menstruation, or stress)

- Transmitted by direct contact with an infected individual
- The lesions of the primary infection occur at the site of inoculation

Herpes labialis: most common type of recurrent oral herpes simplex infection that occurs on the vermilion border of the lips

- Also called cold sore or fever blister

Herpetic whitlow: a painful infection of the fingers caused by the herpes simplex virus

Varicella-zoster virus: the virus that causes both chickenpox and shingles

Chickenpox: a highly contagious disease caused by the varicella-zoster virus characterized by vesicular and pustular eruptions of the skin and/or mucous membranes as well as headache, fever, and malaise

- Usually occurs in children
- Usually one episode of chickenpox
- Recovery in approximately 2-3 weeks

Shingles: a disease caused by the varicella-zoster virus characterized by a unilateral, painful eruption of vesicles along the distribution of a sensory nerve

- Occurs in adults
- Vaccine available

Epstein-Barr virus: a herpesvirus associated with several diseases that occur in the oral region

Infectious mononucleosis: an infectious disease caused by the Epstein-Barr virus characterized by a sore throat, fever, generalized lymphadenopathy, enlarged spleen, malaise, and fatigue

Coxsackieviruses: a group of viruses that cause several infectious diseases

Herpangina: an infectious disease caused by a coxsackievirus characterized by vesicles on the soft palate, along with fever, malaise, sore throat, and dysphagia

Hand, foot, and mouth disease: an infectious disease caused by a coxsackievirus characterized by painful vesicles and ulcers that can occur anywhere in the mouth

Measles: a highly contagious disease with systemic symptoms and a skin rash

Mumps: a viral infection of the salivary glands (most commonly bilateral swelling of the parotid glands)

Acquired immunodeficiency syndrome (AIDS): a syndrome involving a defect in cell-mediated immunity that has a long incubation period, follows a protracted and debilitating course, manifests as opportunistic infections, and has a poor prognosis without treatment

- Infects cells of the immune system that have the CD4 receptor on their cell surfaces

Western blot test: a confirmatory test for HIV infection that identifies antibodies to HIV proteins and glycoproteins

Slides 39-42: Congenital Disorders and Syndromes

Congenital disorder: a disorder that is present at birth

- It can either be inherited or developmental

Syndrome: a set of signs or symptoms or both occurring together

Trisomy 21, or Down syndrome: a type of abnormality in which three instances of chromosome 21 are found, instead of two

- This results in abnormal physical characteristics and mental impairment
- Characteristics include slanted eyes, fissured tongue, macroglossia, premature loss of

teeth, hypodontia, and are generally shorter than normal

- Heart abnormalities are present in more than 30% of individuals with Trisomy 21
- Gingival and periodontal disease have been reported in 90% of affected individuals

*Use Periodontal Disease Classification Model

Cyclic neutropenia: a hereditary disease characterized by a cyclic decrease in the number of circulating neutrophils; the cycle occurs in intervals of 21-27 days, and the episodes of neutropenia persist for 2-3 days

- Systemic manifestations: fever, malaise, sore throat, occasional cutaneous infections
- Oral manifestations: severe ulcerative gingivitis or gingivostomatitis, areas of ulceration can also occur on the tongue and surfaces of the oral mucosa
- Ulcers are very painful, have a craterlike appearance, are variable in size, and have a bleeding base
- When neutrophils return to normal, oral lesions tend to improve

Clinical ramifications: Dental treatment should be initiated when circulating neutrophil count is normal, to reduce risk of complications (such as, gingival hemorrhage and secondary infection).

Cherubism: a disorder beginning in childhood characterized by progressive bilateral facial swelling that can occur in either the maxilla or mandible, with involvement of the mandible being most common

- The swollen jaws and raised eyes give a “cherublike” appearance
- Increased distance between the eyes and eyes are tilted upward, showing more sclera than normal below the iris
- Multilocular radiolucent lesions seen on radiographs resemble “soap-bubbles”

Cleft lip: congenital anomaly of the face caused by the failure of fusion between the embryonic maxillary and medial nasal processes

Cleft palate: congenital anomaly of the oral cavity caused by the failure of fusion between the embryonic palatal shelves

Slides 43-51: Various New Growths and Tumors

Neoplasm: tumor, a new growth of tissue in which the growth is uncontrolled and progressive

Tumor: a neoplasm, a swelling or enlargement

Benign: a condition that, if untreated or treated symptomatically, will not become life threatening

Malignant: resistant to treatment, able to metastasize and kill the host, describing cancer

Cancer: malignancy

Lipoma: a benign tumor of fat

Osteoma: benign tumor of normal compact bone

Carcinomas: a malignant tumor of epithelial tissue origin

Papilloma: a benign tumor of squamous epithelium that presents as a small, exophytic, pedunculated, or sessile growth

Papillomas are cauliflower-like in appearance and occur most often on the soft palate or on the tongue. They are treated by surgical excision, which must include the base of the growth.

A papilloma is pictured on slide 43.

Squamous cell carcinoma: a malignant tumor of squamous epithelium

- Most common primary malignancy of the oral cavity
- Most common sites in oral cavity are the floor of the mouth, ventrolateral tongue, soft palate, and tonsillar pillar

Basal cell carcinoma: a malignant skin tumor associated with excessive sun exposure that appears as a nonhealing ulcer with characteristic rolled borders

- Does not occur in the oral cavity

Pleomorphic adenoma: most common of the benign salivary gland tumors

- Also called benign mixed tumor since the encapsulated tumor is composed of a mixture of both epithelium and connective tissue
- Most common extraoral location: parotid gland
- Most common intraoral location: palate
- Appears as a slowly enlarging, nonulcerated, painless, dome-shaped mass

Odontogenic tumors: a tumor derived from tooth-forming tissues; most often benign

Ameloblastoma: a benign, slow-growing (but locally aggressive) epithelial odontogenic tumor that may arise in either the maxilla or mandible

Cementoblastoma: a benign, cementum-producing neoplasm that is fused to the root or roots of a vital tooth

When an ameloblastoma occurs in the maxilla, death can result from direct extension into the brain and adjacent vital structures.

Pictured on slide 46 is a cementoblastoma.

Odontoma: an odontogenic tumor composed of mature enamel, dentin, cementum, and pulp tissue

- Most common of the odontogenic tumors, and there are two types: compound and complex

Compound odontoma: consists of a collection of numerous small teeth

Complex odontoma: radiographically consists of a mass of enamel, dentin, cementum, and pulp, which

does not resemble a normal tooth; commonly occurs in the posterior mandible

Pictured on slide 47 is a complex odontoma.

Hemangioma: a benign proliferation of capillaries

- Common vascular lesion (represents a developmental lesion rather than a tumor)
- May occur in adults as a result of trauma
- Most common intraoral location: tongue
- Many undergo spontaneous remission, others can enlarge rapidly because of hemorrhage, thrombosis, or inflammation

Kaposi sarcoma: a malignant vascular tumor that may arise in multiple sites, including the skin and oral cavity

Melanoma: a malignant tumor of melanocytes

- ABCDEs of melanoma
 - A – Asymmetric
 - B – Borders
 - C – Color
 - D – Diameters larger than 6 mm
 - E – Evolving

In HIV-positive patients, the lesions associated with Kaposi sarcoma are often seen on the hard palate and gingiva, where they present as purple macules, plaques, or exophytic tumors.

The ABCDEs is a mnemonic that should be considered when assessing a lesion. Lesions that exhibit these characteristics should be further evaluated. Asymmetric: if one half is different from the other; Borders: lesions that have irregular borders; Color: lesions with color variation from tan to black and possibly red or blue; Diameters: lesions with diameters larger than 6 mm; Evolving: lesions that are changing in size, shape, or color.

Osteosarcoma: a malignant tumor of the bone-forming tissue

- Most common primary malignant tumor of bone in patients under 40 years old

- In some cases, widening of the PDL and a sunburst pattern can be seen radiographically

Chondroma: a benign tumor of cartilage

Chondrosarcoma: a malignant tumor of cartilage that can occur in either the maxilla or mandible

Lymphoma: a malignant tumor of lymphoid tissue

The picture on slide 50 shows osteosarcoma on a dental X-ray.

Leukemia: a form of cancer characterized by an overproduction of atypical white blood cells

- Can be acute or chronic
- Acute: common in children and young adults
 - Characterized by an excess proliferation of immature white blood cells
- Chronic: most common in middle-aged adults
 - Characterized by an excess proliferation of mature white blood cells
- Common oral manifestation: diffuse gingival enlargement with persistent bleeding

The atypical white blood cells proliferate in the bone marrow and then spill into the circulating blood and tissues.

Acute leukemias generally tend to have a more aggressive clinical course and require immediate treatment because immature white blood cells proliferate faster than mature white blood cells.

Slide 52: Nonneoplastic Diseases of Bones

Periapical cemento-osseous dysplasia: a relatively common disease of unknown cause that affects periapical bone

Focal cemento-osseous dysplasia: an asymptomatic fibro-osseous lesion that typically arises in the posterior mandible hard tissue

Paget disease of bone: a chronic metabolic bone disease characterized by resorption, osteoblastic repair, and remineralization of the involved bone

Paget disease of bone typically involves the pelvis and spinal column. When the maxilla or mandible is involved, spacing between the teeth increases as the bone enlarges. Edentulous patients may complain that their dentures no longer fit. Pictured is the “cotton-wool” appearance seen on a radiograph.

Slides 53-59: Oral Manifestations of Systemic Diseases

Hyperpituitarism: excess hormone production by the anterior pituitary gland

- Gigantism may result

Gigantism: excessive growth and height

Acromegaly: a disorder that is caused by chronic overproduction of growth hormone by the pituitary gland is characterized by a gradual and permanent enlargement of bones after closure of epiphyseal plates

- Enlargement of maxillary sinus causes a characteristically deep voice
- Enlargement of the maxilla and mandible results in separation of teeth and malocclusion
- Thickened lips, macroglossia, and mandibular prognathism also seen

Hyperthyroidism (Graves’ disease): a condition characterized by excessive production of thyroid hormone

- Goiter, rosy complexion, erythema of the palms, excessive sweating, fine hair, and softened nails
- Exophthalmos: protrusion of the eyeballs is a common characteristic

Hypothyroidism: a condition characterized by decreased output of thyroid hormone

Diabetes mellitus: a chronic disorder of carbohydrate metabolism that is characterized by abnormally high blood glucose levels

- Caused by a lack of the hormone insulin, defective insulin that does not work properly, or increased insulin resistance
- Increased prevalence of oral candidiasis and xerostomia
- Accentuated response to plaque
- Direct systemic link to periodontal disease

Celiac disease: a chronic disorder associated with sensitivity to gluten

Diabetes has a direct systemic link to periodontal disease due to slow wound healing and an increased susceptibility to infection.

Addison disease: a condition characterized by insufficient production of adrenal steroids

- Causes stimulation of melanocytes which causes brown pigmentation or bronzing of the skin and melanotic macules can develop in the oral mucosa

Cushing syndrome: caused by a sustained increase in glucocorticoid levels

- Most common cause is long-term corticosteroid therapy for autoimmune disease and organ transplant
- Common clinical feature: very rounded facial appearance referred to as “moon” faces

Anemia: reduction to less than the normal number of red blood cells, quantity of hemoglobin, or volume of packed red blood cells in the blood

- Most common deficiencies are of iron, folic acid, or vitamin B12

Sickle cell anemia: an inherited disorder of the blood that is found predominantly in black individuals and those of Mediterranean origin

Iron deficiency anemia: a condition that occurs when an insufficient amount of iron is supplied to the bone marrow for red blood cell development

- Most common anemia in the U.S.
- Manifestations: angular cheilitis, pallor of the oral tissues, an erythematous, depapillated, smooth, painful, burning tongue

Pernicious anemia: anemia caused by impaired vitamin B12 absorption, resulting from a deficiency of intrinsic factor, a substance secreted by the parietal cells of the stomach

- Intrinsic factor is necessary for the absorption of vitamin B12
- Manifestations angular cheilitis, mucosal pallor, painful atrophic and erythematous mucosa, mucosal ulceration, loss of papilla on the dorsum of the tongue, and burning and painful tongue

Radiation therapy: the treatment of a disease or condition with a type of radiation

- Patient often experiences mucositis
- Mucositis: painful and appears as erythematous and ulcerated mucosa
- Have trouble eating, pain when swallowing, and loss of taste can occur as a result
- Irreversible salivary gland destruction can occur, resulting in severe xerostomia
- Prone to development of radiation caries and oral candidiasis

Chemotherapy: cancer treatment that uses chemical agents to modify or destroy cancer cells

Patient may experience mucositis and ulcerations as well as anemia. They are at an increased risk for opportunistic infections because of a decrease in white blood cells. These patients are also at

increased risk for bleeding problems because of a decrease in the number of platelets. Patients should have an oral evaluation before initiating radiation therapy; potential sources of oral infection should be eliminated, and teeth for which the prognosis is questionable should be removed.

*Use Six Times Caries Anatomy Model.

Name: _____

Class: _____

Dental Pathology Presentation Guide

Directions: Complete the following information as you listen to the Lesson 3 presentation.

Dental Anomalies

An _____ is something that deviates from what is standard or normal.

- The absence of a single tooth or multiple teeth is known as _____
- The development of one or more extra teeth is known as _____ teeth
- More than the normal number of roots is known as _____ roots
- Abnormally small or large teeth are called _____ or _____, respectively
- A developmental disturbance caused by the invagination of an enamel organ into the dental papilla is known as _____ in _____
- A small, rounded enamel extension forming extra cusps is known as a _____
- When a single tooth germ tries to divide and develops a large single-rooted tooth with one pulp cavity, it is referred to as _____
- The union of two adjacent tooth germs that result in a large tooth with two pulp cavities and one fewer tooth in the dentition is referred to as _____
- The union of the root structure of two or more teeth by cementum is referred to as _____
- An abnormal bend or curve in the root of a tooth is known as _____
- An accessory cusp located in the cingulum of a maxillary or mandibular permanent incisor is known as a _____ cusp
- A condition characterized by very large, pyramid-shaped molars with large pulp chambers and short roots is known as _____
- A permanent tooth showing enamel hypoplasia resulting from infection or trauma to the deciduous teeth is a _____ tooth
- A condition resulting from the ingestion of high concentrations of fluoride, causing the affected teeth to have a mottled discoloration of the enamel is known as: dental _____
- This occurs because of the deposition of substances circulating systemically during tooth development: _____ staining of the teeth
- The incomplete or defective formation of enamel, resulting in the alteration of tooth form or color is known as enamel _____
- A developmental anomaly that results in a disturbance of the maturation of the enamel matrix is known as enamel _____
- An enamel sphere on a root is called an enamel _____
- A broad group of conditions that affect the structural formation of enamel is known as _____ imperfecta
- A disturbance of the dentin of genetic origin is known as _____ imperfecta

Clinical Appearances of Soft Tissue Lesions

- A circumscribed, elevated lesion that is more than 5 mm in diameter, usually containing serous fluid, and looks like a blister _____
- A segment or lobe that is part of a whole _____
- A flat area usually distinguished by a color different than that of surrounding tissue _____
- A small, circumscribed lesion usually less than 1 cm in diameter that is elevated and protrudes above the surface of surrounding tissue _____
- A lesion attached by a stem-like or stalk-like base _____
- Various sized circumscribed elevations containing pus _____
- Base of a lesion that is flat or broad instead of stem-like _____
- A small, elevated lesion less than 1 cm in diameter that contains serous fluid _____

Soft Tissue Consistency

A palpable solid lesion up to 1 cm in diameter found in soft tissue: _____

Color of Lesion

Abnormal redness of the mucosa or gingiva is referred to as _____. A clinical term used to describe an oral mucosal lesion that appears as a smooth, red patch or granular red and velvety patch:

Erythroplakia / Leukoplakia (Circle One). A clinical term for a white plaque-like lesion on the oral mucosa that cannot be rubbed off: Erythroplakia / Leukoplakia (Circle One). Paleness of the skin or mucosal tissues is referred to as _____.

Size of a Lesion

Lesions are measured in _____ or _____.

Surface Texture

The surface texture of a lesion can be:

- _____
- Fissured
- _____
- Smooth
- Rough
- Folded

Radiographic Terms Used to Describe Lesions in Bone

The process by which parts of a whole join, or fuse, to make one is referred to as _____. A lesion with borders that are not well defined, making it difficult to detect the exact parameters is _____. A lesion that extends beyond the confines of one distinct area that has many lobes or parts that are somewhat fused together, making up the entire lesion is _____. These lesions resemble _____. Dark areas on a radiograph are Radiopaque / Radiolucent (Circle One). Light or white areas on a radiograph are Radiopaque / Radiolucent (Circle One).

Variations of the Tongue

- Lingual varicosities are lingual veins usually observed on the _____ and _____ surfaces of the tongue
- This lesion appears as red and then paler pink to white patches on the tongue body. It changes shape with time and resembles a _____ map: _____ or _____ tongue
- Tongue lesion marked by dead cells and keratin buildup that becomes extrinsically stained: _____ tongue

Inflammation and repair

Injury is the result of an alteration in the environment that causes tissue damage. Severe injury may result in necrosis. Necrosis is the pathologic death of one or more cells or a portion of tissue or organ, resulting from irreversible damage. Inflammation is a nonspecific response to injury.

Inflammation may be:

1. Acute
2. _____
3. Systemic
4. _____

Exudate is an inflammatory fluid formed as a reaction to injury of tissues and blood vessels. Exudate have a watery consistency called _____ exudate, or may be thick, white-to-yellow pus that contains tissue debris and many white blood cells called _____ exudate. This type of exudate is also known as _____.

An abscess is:

_____.

A fistula is:

The immature, initial tissue formed in the connective tissue of an injury is known as _____ tissue.

This type of chemical injury occurs when a patient places an aspirin tablet directly on mucosal tissue instead of swallowing it: _____

A lesion that results from the accumulation of blood within tissue because of trauma is a _____.

An **amalgam tattoo** is a flat, bluish-gray lesion of the oral mucosa resulting from the introduction of _____ into the tissue. Metallic particles disperse in the tissue and result in a permanent area of pigmentation. If large enough, it may be seen as _____ on a radiograph.

Solar or actinic cheilitis is the degeneration of the tissue of the lips caused by _____. The lips appear dry and cracked. _____ appear at right angles to the skin and vermillion junction.

Pyogenic granuloma is a benign, reacting, painless, commonly occurring intraoral lesion characterized by proliferation of connective tissue containing numerous blood vessels and inflammatory cells. It is seen most in _____.

An abscess composed of pus and surrounded by connective tissue containing neutrophils and lymphocytes is a:

Periapical abscess / Periapical granuloma (Circle One)

A localized mass of chronically inflamed granulation tissue that forms at the opening of a pulp canal, generally at the apex of a nonvital tooth root is a:

Periapical abscess / Periapical granuloma (Circle One)

A cyst attached to the root apex of a tooth with a necrotic pulp or a defective root canal filling is a _____ cyst. A cyst that forms when a tooth is removed and all or part is left behind is a _____ cyst.

This very painful postoperative complication of a tooth extraction in which, after extraction, the blood clot breaks down and is lost before healing occurs is known as alveolar osteitis, or _____.

Oral Immunologic Lesions

Recurrent aphthous ulcers, (aka _____), are painful oral ulcers of unknown cause.

Erythema multiforme is an acute, self-limited disease that affects the skin and mucous membranes. It is usually triggered by drug exposure. Ulcers frequently form on the lateral surfaces of the tongue. The characteristic lesion associated with this disease is a _____ or _____ lesion.

Lichen planus is a benign, chronic disease affecting the skin and oral mucosa. A common characteristic for this disease is a _____ of interconnecting white lines and circles.

Sjögren's syndrome is an autoimmune disease that affects the _____ and _____ glands, resulting in a decrease in _____ and _____.

Infectious Diseases

Syphilis is a disease caused by the spirochete *Treponema pallidum* usually transmitted through sexual contact with a partner with an active lesion, by blood, or transmission from a mother to a fetus through the placenta. It has three stages with three different lesions per stage:

1. Primary stage: _____

2. Secondary stage: mucous patches

3. Tertiary: _____

This stage is the most infectious: _____

This type of syphilis is transmitted from an infected mother to the fetus: _____

Necrotizing ulcerative gingivitis (NUG) is a painful erythematous gingivitis with necrosis of the interdental papillae.

- It presents with _____ and _____
- It also presents with _____

The most common oral fungal infection is _____, which is an overgrowth of the yeastlike fungus *Candida albicans*. This infection can result from antibiotic use, cancer, corticosteroid therapy, dentures, diabetes mellitus, and HIV infection. The most common type of candidiasis affecting the oral mucosa due to irritation from a denture is called _____.

Recurrent herpes simplex infection results from the herpes simplex virus that persists in a latent state and causes localized recurrent infections (usually produced by stimuli such as sunlight, menstruation, or stress).

The most common type of recurrent oral herpes simplex infection that occurs on the vermilion border of the lips, also called a cold sore or fever blister, is known as:

Herpetic whitlow / Herpes labialis (Circle One)

A painful infection of the fingers caused by the herpes simplex virus is known as:

Herpetic whitlow / Herpes labialis (Circle One)

This virus causes both chickenpox and shingles: _____

Chickenpox usually occurs in _____

Shingles usually occurs in _____

Infectious mononucleosis is an infectious disease caused by the _____ virus characterized by a sore throat, fever, generalized lymphadenopathy, enlarged spleen, malaise, and fatigue.

Coxsackieviruses are a group of viruses that cause several different infectious diseases.

Different infectious diseases caused by a coxsackievirus

1. Herpangina
2. _____, _____, _____ disease
3. Measles
4. _____

Acquired immunodeficiency syndrome (AIDS) is a syndrome involving a defect in cell-mediated immunity that has a long incubation period, follows a protracted and debilitating course, manifests as opportunistic infections, and has a poor prognosis without treatment. It infects cells of the immune system that have the _____ receptor on their cell surfaces. A confirmatory test for HIV infection that identifies antibodies to HIV proteins and glycoproteins is called the _____ test.

Congenital Disorders and Syndromes

Trisomy 21, or Down syndrome, is a type of abnormality in which three instances of chromosome 21 are found instead of two. This results in abnormal physical characteristics and mental impairment. Characteristics include:

- Slanted eyes
- Fissured tongue
- _____
- _____
- _____
- Generally shorter than normal

Cyclic neutropenia is a hereditary disease characterized by a cyclic decrease in the number of circulating neutrophils; the cycle occurs in intervals of _____ to _____ days, and the episodes of neutropenia persist for _____ to _____ days.

Cherubism is a disorder beginning in childhood characterized by progressive bilateral facial swelling that can occur in either the maxilla or mandible, with involvement of the mandible being most common. The eyes have increased _____ and are tilted _____, showing more sclera than normal below the iris. Multilocular radiolucent lesions seen on radiographs resemble _____.

A congenital anomaly of the face caused by the failure of fusion between the embryonic maxillary and medial nasal processes:

Cleft Lip / Cleft Palate (Circle One)

A congenital anomaly of the oral cavity caused by the failure of fusion between the embryonic palatal shelves:

Cleft Lip / Cleft Palate (Circle One)

Various New Growths and Tumors

A condition that, if untreated or treated symptomatically, will not become life threatening is:

Benign / Malignant (Circle One)

Resistant to treatment; able to metastasize and kill the host:

Benign / Malignant (Circle One)

_____ : a benign tumor of fat

_____ : benign tumor of normal compact bone

_____ : a malignant tumor of epithelial tissue origin

_____ : a benign tumor of squamous epithelium

A papilloma is _____-like in appearance.

Squamous cell carcinoma is a malignant tumor of squamous epithelium. It is the most common primary malignancy of the oral cavity. The most common sites found in the oral cavity are on the:

- _____ of the mouth
- _____ tongue
- _____ palate
- Tonsillar pillar

Basal cell carcinoma is a malignant skin tumor associated with excessive sun exposure that appears as a nonhealing ulcer with characteristic rolled borders.

Does basal cell carcinoma appear in the oral cavity? Yes / No (Circle One)

Pleomorphic adenoma is the most common of the benign salivary gland tumors. It is also called _____ tumor since the encapsulated tumor is composed of a mixture of both epithelium and connective tissue.

- Most common extraoral location: _____
- Most common intraoral location: _____

A tumor derived from tooth-forming tissues is an _____ tumor.

A benign, slow-growing (but locally aggressive) epithelial odontogenic tumor that may arise in either the maxilla or the mandible is an _____.

A benign cementum-producing neoplasm that is fused to the root or roots of a vital tooth is a _____. It is seen radiographically as a well-defined radiopaque mass fused to the tooth root surrounded by a radiolucent _____.

What symptom of this tumor is different from other odontogenic tumors? _____

An odontoma is an odontogenic tumor composed of mature enamel, dentin, cementum, and pulp tissue. There are two types: compound and complex odontomas.

This type consists of a collection of numerous small teeth:

Compound / Complex (Circle One)

This type radiographically consists of a mass of enamel, dentin, cementum, and pulp, which does not resemble a normal tooth:

Compound / Complex (Circle One)

A benign proliferation of capillaries is a: _____

Kaposi sarcoma is a malignant vascular tumor that may arise in multiple sites, including the skin and oral cavity. **Melanoma** is a malignant tumor of melanocytes. The **ABCDEs of melanoma** is a mnemonic that should be considered when assessing a lesion. Lesions that exhibit these characteristics should be further evaluated.

- ABCDEs of melanoma

- A – _____
- B – _____
- C – _____
- D – _____
- E – _____

_____ : a malignant tumor of the bone-forming tissue

_____ : benign tumor of cartilage

_____ : a malignant tumor of cartilage that can occur in either the maxilla or mandible

_____ : a malignant tumor of lymphoid tissue

Leukemia is a form of cancer characterized by an overproduction of atypical white blood cells. It can be acute or chronic.

- Acute: common in _____ and _____
 - Characterized by an excess proliferation of _____ white blood cells
- Chronic: most common in _____
 - Characterized by an excess proliferation of _____ white blood cells

Oral Manifestations of Systemic Diseases

Acromegaly is a disorder that is caused by chronic overproduction of _____ hormone by the pituitary gland is characterized by a gradual and permanent enlargement of bones after closure of epiphyseal plates. Some characteristics include:

- _____ lips
- _____
- _____

Hyperthyroidism (Graves' disease) is a condition characterized by excessive production of thyroid hormone. Some characteristics include goiter, rosy complexion, erythema of the palms, excessive sweating, fine hair, and softened nails. The most common characteristic is _____ or protrusion of the eyeballs.

Diabetes mellitus is a chronic disorder of carbohydrate metabolism that is characterized by abnormally high blood glucose levels.

- Increased prevalence of _____ and _____
- Accentuated response to _____
- Direct systemic link to _____

Addison disease is a condition characterized by insufficient production of _____. It causes stimulation of melanocytes which causes brown pigmentation/bronzing of the skin and melanotic macules can develop in the oral mucosa. **Cushing syndrome** is caused by a sustained increase in glucocorticoid levels. The most common associated clinical feature is a very rounded facial appearance referred to as _____.

Anemia is the reduction to less than the normal number of red blood cells, quantity of hemoglobin, or volume of packed red blood cells in the blood.

_____ anemia is an inherited disorder of the blood that is found predominantly in black individuals and those of Mediterranean origin.

_____ anemia is a condition that occurs when an insufficient amount of iron is supplied to the bone marrow for red blood cell development. One of the most common related oral manifestations is a _____, _____ tongue.

_____ anemia is caused by impaired vitamin B12 absorption, resulting from a deficiency of intrinsic factor.

- Intrinsic factor is necessary for the absorption of vitamin _____
- One of the most common related oral manifestations is also a _____, _____ tongue

Radiation therapy is the treatment of a disease or condition with a type of radiation.

- Patients often experience _____
- _____ is painful and appears as erythematous and ulcerated mucosa
- Individuals have trouble _____, pain on _____, and loss of _____ can occur as a result
- Irreversible salivary gland destruction can occur, resulting in severe _____

- Prone to development of radiation caries and oral candidiasis

Chemotherapy is a cancer treatment that uses chemical agents to modify or destroy cancer cells.

Dental Pathology Presentation Guide – Answer Key

Directions: Complete the following information as you listen to the Lesson 3 presentation.

Dental Anomalies

An **anomaly** is something that deviates from what is standard or normal.

- The absence of a single tooth or multiple teeth is known as **anodontia**
- The development of one or more extra teeth is known as **supernumerary** teeth
- More than the normal number of roots is known as **supernumerary** roots
- Abnormally small or large teeth **microdontia** or **macrodontia**, respectively
- A developmental disturbance caused by the invagination of an enamel organ into the dental papilla is known as **dens** in **dente**
- A small, rounded enamel extension forming extra cusps is known as a **tubercle**
- When a single tooth germ tries to divide and develops a large single-rooted tooth with one pulp cavity, it is referred to as **gemination**
- The union of two adjacent tooth germs that result in a large tooth with two pulp cavities and one fewer tooth in the dentition is referred to as **fusion**
- The union of the root structure of two or more teeth by cementum is referred to as **concrecence**
- An abnormal bend or curve in the root of a tooth is known as **dilaceration**
- An accessory cusp located in the cingulum of a maxillary or mandibular permanent incisor is known as a **talon** cusp
- A condition characterized by very large, pyramid-shaped molars with large pulp chambers and short roots is known as **taurodontism**
- A permanent tooth showing enamel hypoplasia resulting from infection or trauma to the deciduous teeth is a **Turner** tooth
- A condition resulting from the ingestion of high concentrations of fluoride, causing the affected teeth to have a mottled discoloration of the enamel is known as: dental **fluorosis**
- This occurs because of the deposition of substances circulating systemically during tooth development: **intrinsic** staining of the teeth
- The incomplete or defective formation of enamel, resulting in the alteration of tooth form or color is known as enamel **hypoplasia**
- A developmental anomaly that results in a disturbance of the maturation of the enamel matrix is known as enamel **hypocalcification**
- An enamel sphere on a root is called an enamel **pearl**
- A broad group of conditions that affect the structural formation of enamel is known as **amelogenesis** imperfecta
- A disturbance of the dentin of genetic origin is known as **dentinogenesis** imperfecta

Clinical Appearances of Soft Tissue Lesions

- A circumscribed, elevated lesion that is more than 5 mm in diameter, usually containing serous fluid, and looks like a blister **bulla**
- A segment or lobe that is part of a whole **lobule**
- A flat area usually distinguished by a color different than that of surrounding tissue **macule**
- A small, circumscribed lesion usually less than 1 cm in diameter that is elevated and protrudes above the surface of surrounding tissue **papule**
- A lesion attached by a stemlike or stalk-like base **pedunculated**
- Various sized circumscribed elevations containing pus **pustules**
- Base of a lesion that is flat or broad instead of stem-like **sessile**
- A small, elevated lesion less than 1 cm in diameter that contains serous fluid **vesicle**

Soft Tissue Consistency

A palpable solid lesion up to 1 cm in diameter found in soft tissue: **nodule**

Color of Lesion

Abnormal redness of the mucosa or gingiva is referred to as **erythema**. A clinical term used to describe an oral mucosal lesion that appears as a smooth red patch or granular red and velvety patch:

Erythroplakia / Leukoplakia (Circle One). A clinical term for a white plaque-like lesion on the oral mucosa that cannot be rubbed off: Erythroplakia / **Leukoplakia** (Circle One). Paleness of the skin or mucosal tissues is referred to as **pallor**.

Size of a Lesion

Lesions are measured in **centimeters** or **millimeters**.

Surface Texture

The surface texture of a lesion can be:

- **Corrugated**
- Fissured
- **Papillary**
- Smooth
- Rough
- Folded

Radiographic Terms Used to Describe Lesions in Bone

The process by which parts of a whole join, or fuse, to make one is referred to as **coalescence**. A lesion with borders that are not well defined making it difficult to detect the exact parameters is **diffuse**. A lesion that extends beyond the confines of one distinct area that has many lobes or parts that are somewhat fused together, making up the entire lesion is **multilocular**. These lesions resemble **soap bubbles**. Dark areas on a radiograph are **Radiopaque** / **Radiolucent** (Circle One). Light or white areas on a radiograph are **Radiopaque** / **Radiolucent** (Circle One).

Variations of the Tongue

- Lingual varicosities are lingual veins usually observed on the **ventral** and **lateral** surfaces of the tongue
- This lesion appears as red and then paler pink to white patches on the tongue body. It changes shape with time and resembles a **geographic** map: **Erythema migrans** or **geographic** tongue
- Tongue lesion marked by dead cells and keratin buildup that becomes extrinsically stained: **Black hairy** tongue

Inflammation and repair

Injury is the result of an alteration in the environment that causes tissue damage. Severe injury may result in necrosis. Necrosis is the pathologic death of one or more cells or a portion of tissue or organ, resulting from irreversible damage. Inflammation is a nonspecific response to injury.

Inflammation may be:

1. Acute
2. **Chronic**
3. Systemic
4. **Local**

Exudate is an inflammatory fluid formed as a reaction to injury of tissues and blood vessels. Exudate have a watery consistency called **serous** exudate, or may be thick, white-to-yellow pus that contains tissue debris and many white blood cells called **purulent** exudate. This type of exudate is also known as **suppuration**.

An abscess is:

a collection of purulent exudate that has accumulated in a contained space formed by the surrounding tissue

A fistula is:

the formation of a drainage passage that bores through tissue, allowing drainage to the outside

The immature, initial tissue formed in the connective tissue of an injury is known as **granulation** tissue.

This type of chemical injury occurs when a patient places an aspirin tablet directly on mucosal tissue instead of swallowing it: **aspirin burn**

A lesion that results from the accumulation of blood within tissue because of trauma is a **hematoma**.

An **amalgam tattoo** is a flat, bluish-gray lesion of the oral mucosa resulting from the introduction of **amalgam particles** into the tissue. Metallic particles disperse in the tissue and result in a permanent area of pigmentation. If large enough, it may be seen as **radiopacities** on a radiograph.

Solar or actinic cheilitis is the degeneration of the tissue of the lips caused by **sun exposure**. The lips appear dry and cracked. **Fissures** appear at right angles to the skin and vermilion junction.

Pyogenic granuloma is a benign, reacting, painless, commonly occurring intraoral lesion characterized by proliferation of connective tissue containing numerous blood vessels and inflammatory cells. It is seen most in **pregnant women**.

An abscess composed of pus and surrounded by connective tissue containing neutrophils and lymphocytes is a:

Periapical Abscess / Periapical granuloma (Circle One)

A localized mass of chronically inflamed granulation tissue that forms at the opening of a pulp canal, generally at the apex of a nonvital tooth root is a:

Periapical Abscess / **Periapical granuloma** (Circle One)

A cyst attached to the root apex of a tooth with a necrotic pulp or a defective root canal filling is a **radicular** cyst. A cyst that forms when a tooth is removed and all or part is left behind is a **residual** cyst.

This very painful postoperative complication of a tooth extraction in which, after extraction, the blood clot breaks down and is lost before healing occurs is known as alveolar osteitis, or **dry socket**.

Oral Immunologic Lesions

Recurrent aphthous ulcers, (aka **canker sores**), are painful oral ulcers of unknown cause.

Erythema multiforme is an acute, self-limited disease that affects the skin and mucous membranes. It is usually triggered by drug exposure. Ulcers frequently form on the lateral surfaces of the tongue. The characteristic lesion associated with this disease is a **target** or **bull's-eye** lesion.

Lichen planus is a benign, chronic disease affecting the skin and oral mucosa. A common characteristic for this disease is a **lacelike pattern** of interconnecting white lines and circles.

Sjögren's syndrome is an autoimmune disease that affects the **salivary** and **lacrimal** glands, resulting in a decrease in **saliva** and **tears**.

Infectious Diseases

Syphilis is a disease caused by the spirochete *Treponema pallidum* usually transmitted through sexual contact with a partner with an active lesion, by blood, or transmission from a mother to a fetus through the placenta. It has three stages with three different lesions per stage:

1. Primary stage: **chancre**

2. Secondary stage: mucous patches

3. Tertiary: **gumma**

This stage is the most infectious: **secondary**

This type of syphilis is transmitted from an infected mother to the fetus: **congenital syphilis**

Necrotizing ulcerative gingivitis (NUG) is a painful erythematous gingivitis with necrosis of the interdental papillae.

- It presents with **foul odor** and **metallic taste**
- It also presents with **tissue sloughing**

The most common oral fungal infection is **Candidiasis**, which is an overgrowth of the yeastlike fungus *Candida albicans*. This infection can result from antibiotic use, cancer, corticosteroid therapy, dentures, diabetes mellitus, and HIV infection. The most common type of candidiasis affecting the oral mucosa due to irritation from a denture is called **denture stomatitis**.

Recurrent herpes simplex infection results from the herpes simplex virus that persists in a latent state and causes localized recurrent infections (usually produced by stimuli such as sunlight, menstruation, or stress).

The most common type of recurrent oral herpes simplex infection that occurs on the vermilion border of the lips, also called a cold sore or fever blister, is known as:

Herpetic whitlow / **Herpes labialis** (Circle One)

A painful infection of the fingers caused by the herpes simplex virus is known as:

Herpetic whitlow / Herpes labialis (Circle One)

This virus causes both chickenpox and shingles: **Varicella-zoster virus**

Chickenpox usually occurs in **children**

Shingles usually occurs in **adults**

Infectious mononucleosis is an infectious disease caused by the **Epstein-barr** virus characterized by a sore throat, fever, generalized lymphadenopathy, enlarged spleen, malaise, and fatigue.

Coxsackieviruses are a group of viruses that cause several different infectious diseases.

Different infectious diseases caused by a coxsackievirus

1. Herpangina
2. **Hand, foot, and mouth** disease
3. Measles
4. **Mumps**

Acquired immunodeficiency syndrome (AIDS) is a syndrome involving a defect in cell-mediated immunity that has a long incubation period, follows a protracted and debilitating course, manifests as opportunistic infections, and has a poor prognosis without treatment. It infects cells of the immune system that have the **CD4** receptor on their cell surfaces. A confirmatory test for HIV infection that identifies antibodies to HIV proteins and glycoproteins is called the **Western blot** test.

Congenital Disorders and Syndromes

Trisomy 21, or Down syndrome, is a type of abnormality in which three instances of chromosome 21 are found instead of two. This results in abnormal physical characteristics and mental impairment. Characteristics include:

- Slanted eyes
- Fissured tongue
- **Macroglossia**
- **Premature loss of teeth**
- **Hypodontia**
- Generally shorter than normal

Cyclic neutropenia is a hereditary disease characterized by a cyclic decrease in the number of circulating neutrophils; the cycle occurs in intervals of **21** to **27** days, and the episodes of neutropenia persist for **2** to **3** days.

Cherubism is a disorder beginning in childhood characterized by progressive bilateral facial swelling that can occur in either the maxilla or mandible, with involvement of the mandible being most common. The eyes have increased **distance** and are tilted **upward**, showing more sclera than normal below the iris. Multilocular radiolucent lesions seen on radiographs resemble **soap bubbles**.

A congenital anomaly of the face caused by the failure of fusion between the embryonic maxillary and medial nasal processes:

Cleft Lip / Cleft Palate (Circle One)

A congenital anomaly of the oral cavity caused by the failure of fusion between the embryonic palatal shelves:

Cleft Lip / **Cleft Palate** (Circle One)

Various New Growths and Tumors

A condition that, if untreated or treated symptomatically, will not become life threatening is:

Benign / Malignant (Circle One)

Resistant to treatment; able to metastasize and kill the host:

Benign / **Malignant** (Circle One)

Lipoma: a benign tumor of fat

Osteoma: benign tumor of normal compact bone

Carcinoma: a malignant tumor of epithelial tissue origin

Papilloma: a benign tumor of squamous epithelium

A papilloma is **cauliflower**-like in appearance.

Squamous cell carcinoma is a malignant tumor of squamous epithelium. It is the most common primary malignancy of the oral cavity. The most common sites found in the oral cavity are on the:

- **Floor** of the mouth
- **Ventrolateral** tongue
- **Soft** palate
- Tonsillar pillar

Basal cell carcinoma is a malignant skin tumor associated with excessive sun exposure that appears as a nonhealing ulcer with characteristic rolled borders.

Does basal cell carcinoma appear in the oral cavity? Yes / **No** (Circle One)

Pleomorphic adenoma is the most common of the benign salivary gland tumors. It is also called **benign mixed** tumor since the encapsulated tumor is composed of a mixture of both epithelium and connective tissue.

- Most common extraoral location: **parotid gland**
- Most common intraoral location: **palate**

A tumor derived from tooth-forming tissues is an **odontogenic** tumor.

A benign, slow-growing (but locally aggressive) epithelial odontogenic tumor that may arise in either the maxilla or the mandible is an **ameloblastoma**.

A benign cementum-producing neoplasm that is fused to the root or roots of a vital tooth is a **cementoblastoma**. It is seen radiographically as a well-defined radiopaque mass fused to the tooth root surrounded by a radiolucent **halo**.

What symptom of this tumor is different from other odontogenic tumors? **pain**

An odontoma is an odontogenic tumor composed of mature enamel, dentin, cementum, and pulp tissue. There are two types: compound and complex odontomas.

This type consists of a collection of numerous small teeth:

Compound / Complex (Circle One)

This type radiographically consists of a mass of enamel, dentin, cementum, and pulp, which does not resemble a normal tooth:

Compound / **Complex** (Circle One)

A benign proliferation of capillaries is a: **hemangioma**

Kaposi sarcoma is a malignant vascular tumor that may arise in multiple sites, including the skin and the oral cavity. **Melanoma** is a malignant tumor of melanocytes. The **ABCDEs of melanoma** is a mnemonic that should be considered when assessing a lesion. Lesions that exhibit these characteristics should be further evaluated.

- ABCDEs of melanoma
 - A – **Asymmetric**
 - B – **Borders**
 - C – **Colors**
 - D – **Diameter larger than 6 mm**
 - E – **Evolving**

Osteosarcoma: a malignant tumor of the bone-forming tissue

Chondroma: benign tumor of cartilage

Chondrosarcoma: a malignant tumor of cartilage that can occur in either the maxilla or mandible

Lymphoma: a malignant tumor of lymphoid tissue

Leukemia is a form of cancer characterized by an overproduction of atypical white blood cells. It can be acute or chronic.

- Acute: common in **children** and **young adults**
 - Characterized by an excess proliferation of **immature** white blood cells
- Chronic: most common in **middle-aged adults**
 - Characterized by an excess proliferation of **mature** white blood cells

Oral Manifestations of Systemic Diseases

Acromegaly is a disorder that is caused by chronic overproduction of **growth** hormone by the pituitary gland is characterized by a gradual and permanent enlargement of bones after closure of epiphyseal plates. Some characteristics include:

- **Thickened** lips
- **Macroglossia**
- **Mandibular prognathism**

Hyperthyroidism (Graves' disease) is a condition characterized by excessive production of thyroid hormone. Some characteristics include goiter, rosy complexion, erythema of the palms, excessive sweating, fine hair, and softened nails. The most common characteristic is **exophthalmos** or protrusion of the eyeballs.

Diabetes mellitus is a chronic disorder of carbohydrate metabolism that is characterized by abnormally high blood glucose levels.

- Increased prevalence of **oral candidiasis** and **xerostomia**
- Accentuated response to **plaque**
- Direct systemic link to **periodontal disease**

Addison disease is a condition characterized by insufficient production of **adrenal steroids**. It causes stimulation of melanocytes which causes brown pigmentation/bronzing of the skin and melanotic macules can develop in the oral mucosa. **Cushing syndrome** is caused by a sustained increase in glucocorticoid levels. The most common associated clinical feature is a very rounded facial appearance referred to as **"moon" faces**.

Anemia is the reduction to less than the normal number of red blood cells, quantity of hemoglobin, or volume of packed red blood cells in the blood.

Sickle cell anemia is an inherited disorder of the blood that is found predominantly in black individuals and those of Mediterranean origin.

Iron deficiency anemia is a condition that occurs when an insufficient amount of iron is supplied to the bone marrow for red blood cell development. One of the most common related oral manifestations is a **painful, burning** tongue.

Pernicious anemia is caused by impaired vitamin B12 absorption, resulting from a deficiency of intrinsic factor.

- Intrinsic factor is necessary for the absorption of vitamin **B12**
- One of the most common related oral manifestations is also a **burning, painful** tongue

Radiation therapy is the treatment of a disease or condition with a type of radiation.

- Patients often experiences **mucositis**
- **Mucositis** is painful and appears as erythematous and ulcerated mucosa
- Individuals have trouble **eating**, pain on **swallowing**, and loss of **taste** can occur as a result
- Irreversible salivary gland destruction can occur, resulting in severe **xerostomia**
- Prone to development of radiation caries and oral candidiasis

Chemotherapy is a cancer treatment that uses chemical agents to modify or destroy cancer cells.

Lesson Three – Dental Pathology

REVIEW: Identification and Assessment of Dental Pathology

20-30 minutes

Purpose:

Participants will apply the knowledge learned in the lecture. They will identify various instances of pathology on the provided models using the vocabulary flashcards.

Materials:

- Vocabulary flashcards
- Anatomical models
- *Dental Pathology Quiz*
- *Dental Pathology Quiz – Answer Key*

Facilitation Steps:

1. Using their flashcards, have participants review the vocabulary words.
2. Have participants get in a group and quiz each other on the instances of pathology and their characteristics/oral manifestations.
3. To integrate the use of the dental morphology models, have the paired-up participants rotate around the tables where the models are set up in stations again as in the FOCUS section. This time they will use what they learned in the lesson to identify

the different structures/landmarks where the pathology may be detected on the models.

4. Organize the flashcards so that the correct ones are at each table to match each model. Have the paired-up participants point out each structure using the flashcards with the names listed.

Station 1 – Adult Pathologies Model

Station 2 – Pediatric Model with Pathologies

Station 3 – Periodontal Diseases Classification Model

Station 4 – Six Times Caries Anatomy Model

5. Have participants mix the flashcards back up before they rotate to the next station, so each group has a chance to correctly match the flashcards to the structures on the models.
6. When participants are finished at each station, instruct them to take a few minutes to complete the quiz.
7. Have participants self-check their answers as you share from the answer key.

Name: _____ Class: _____

Dental Pathology Quiz

Directions: Select the best answer to the following multiple-choice questions:

1. Something that deviates from what is standard or normal is called a(n):
 - a. Syndrome
 - b. Anomaly
 - c. Disorder
 - d. Atrophy
2. True or False: Fusion is the dental anomaly that involves the union of two adjacent tooth germs that results in a large tooth with two pulp cavities and one fewer tooth in the dentition.
3. The following are terms used to describe the clinical appearance of a soft tissue lesion, except:
 - a. Macule
 - b. Pedunculated
 - c. Radiolucent
 - d. Vesicle
4. True or False: The most infectious stage of syphilis is the primary stage when a chancre is present.
5. Which of the following immunologic diseases has the common characteristic of a “target” or “bull’s eye” lesion?
 - a. Sjögren’s syndrome
 - b. Systemic lupus erythematosus
 - c. Pemphigus vulgaris
 - d. Erythema multiforme
6. Which of the following infectious diseases is caused by a coxsackievirus?
 - a. Herpangina
 - b. Hand, foot, and mouth disease
 - c. Measles
 - d. Mumps
 - e. All the above
7. All the following match the mnemonic for the ABCDEs of melanoma, except:
 - a. A – Asymmetric
 - b. B – Base
 - c. C – Colors
 - d. D – Diameters larger than 6 mm
 - e. E – Evolving
8. Which of the following systemic diseases has a direct systemic link to periodontal disease?
 - a. Graves’ disease
 - b. Addison disease
 - c. Celiac disease
 - d. Diabetes mellitus

Dental Pathology Quiz – Answer Key

1. Something that deviates from what is standard or normal is called a(n):
 - a. **Anomaly**
 - b. Syndrome
 - c. Disorder
 - d. Atrophy
2. **True** or False: Fusion is the dental anomaly that involves the union of two adjacent tooth germs that results in a large tooth with two pulp cavities and one fewer tooth in the dentition.
3. The following are terms used to describe the clinical appearance of a soft tissue lesion, except:
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