



Dental Anatomy

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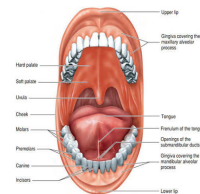
Objectives

- Understand the relevant dental, oral and craniofacial anatomy
- Explain their relevance to patient selection

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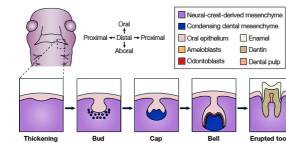
Dental Anatomy

- Tooth Morphology: Types (incisors, canines, premolars, molars), surfaces (mesial, distal, buccal, lingual, occlusal), and root structure.
- Tooth Numbering Systems: FDI and Universal systems.
- Eruption Patterns: Normal eruption sequence and timelines in both primary and permanent dentitions.
- Tooth Development: Stages of tooth formation (bud, cap, bell), enamel and dentin formation.



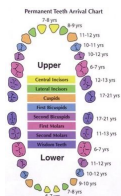
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Tooth Development



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Eruption dates and development



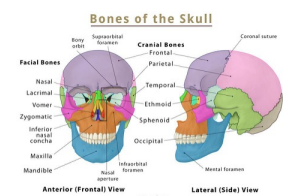
- Primary dentition
- Mixed dentition
- Permanent dentition
- Date/sequence of eruption
- Symmetry of eruption

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Craniofacial Skeletal Anatomy

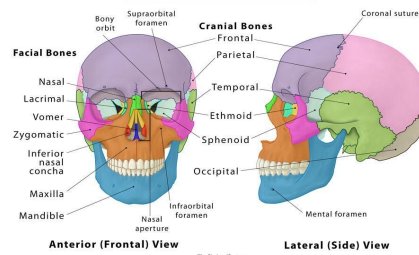
Bones of the Skull:

- Maxilla and Mandible: Sites of most orthodontic treatment.
- Temporomandibular Joint (TMJ): Function and disorders that affect treatment planning.
- Facial Growth:
 - Growth patterns and how they impact timing of treatment.
 - Vertical vs horizontal growth and skeletal classifications (Class I, II, III).



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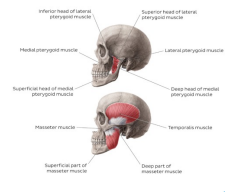
Bones of the Skull



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Muscles of Mastication and Facial Expression

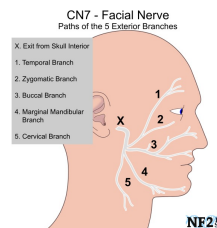
- Affects jaw function and appliance stability.
- Muscles of Mastication: Masseter, temporalis, medial and lateral pterygoids.
- Muscles of Facial Expression: Especially those around the mouth (e.g., orbicularis oris, buccinator).



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Nervous System

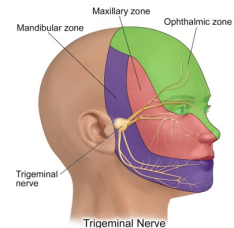
- Facial Nerve (CN VII): Controls muscles of facial expression, important for understanding functional habits like lip posture.



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Nervous System

- Trigeminal Nerve (CN V): Main sensory nerve of the face; innervates the teeth and jaws.



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Vascular System

- Arterial Supply to the Face and Jaws: Mainly via branches of the external carotid artery.
- Venous Drainage: Pterygoid plexus, facial vein.
- Lymphatic Drainage: Nodes relevant to infection and inflammation in the oral cavity.

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Oral and Periodontal Tissues

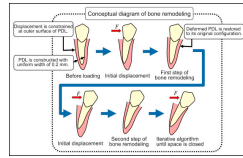
- Gingiva and Periodontal Ligament (PDL):
 - The PDL is vital in orthodontic tooth movement; it responds to forces applied via appliances.
- Alveolar Bone: Undergoes remodeling during tooth movement.
- Mucosa: Understanding types (keratinized vs non-keratinized) aids in appliance placement and patient comfort



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Tooth Movement

- Bone Remodeling: How forces cause bone resorption and deposition.
- Cellular Response: Osteoclasts and osteoblasts activity in the PDL and alveolar bone.
- Force Application: Light vs heavy forces, continuous vs intermittent forces.



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MCQ

1. Which nerve provides sensory innervation to the upper teeth?
 - A. Facial nerve
 - B. Trigeminal nerve (maxillary branch)
 - C. Glossopharyngeal nerve
 - D. Hypoglossal nerve
2. Which structure is directly responsible for bone resorption during orthodontic tooth movement?
 - A. Osteoblasts
 - B. Cementoblasts
 - C. Osteoclasts
 - D. Fibroblasts

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MCQs

3. Which of the following bones forms the upper jaw?
 - A. Mandible
 - B. Maxilla
 - C. Zygomatic bone
 - D. Palatine bone
4. Which muscle is primarily responsible for closing the jaw during mastication?
 - A. Lateral pterygoid
 - B. Buccinator
 - C. Temporalis
 - D. Orbicularis oris

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MCQ

5. What type of tissue lines the attached gingiva?
 - A. Non-keratinized epithelium
 - B. Simple squamous epithelium
 - C. Keratinized stratified squamous epithelium
 - D. Transitional epithelium

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Short Answer Questions

- Name three muscles involved in mastication and describe their role.
- Describe the role of the periodontal ligament in orthodontic tooth movement.
- List the typical eruption ages of the permanent first molars and central incisors.
- What changes occur in the alveolar bone in response to orthodontic forces?
- Identify the main blood vessel supplying the maxillary arch.

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Answers

Name three muscles involved in mastication and describe their role.

- Masseter: Elevates (closes) the mandible.
- Temporalis: Elevates and retracts the mandible.
- Medial Pterygoid: Works with the masseter to elevate the mandible and assists with side-to-side movement.

Describe the role of the periodontal ligament (PDL) in orthodontic tooth movement.

- The PDL connects the tooth root to the alveolar bone.
- When orthodontic force is applied, the PDL transmits pressure and tension to the surrounding bone, stimulating osteoclasts on the pressure side (resorption) and osteoblasts on the tension side (deposition), allowing tooth movement.

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Answers

List the typical eruption ages of the permanent first molars and central incisors.

- First permanent molars: Around 6 years old
- Central incisors: 6–8 years (mandibular earlier than maxillary)

What changes occur in the alveolar bone in response to orthodontic forces?

- Bone is resorbed on the pressure side and deposited on the tension side, allowing the tooth to gradually move through the alveolar process without damaging the surrounding structures.

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Facial Growth

- Facial growth begins in utero and continues into the late teens or early twenties. It is influenced by:
 - Genetic factors – inherited growth patterns
 - Functional forces – breathing, swallowing, chewing, and speaking
 - Hormonal influences – especially during puberty
 - Environmental factors – habits (e.g., thumb sucking), nutrition, trauma



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Phases of Facial Growth

Infant and Early Childhood (0–6 years)

- Rapid growth of the brain and skull
- Face is small compared to the cranium
- Maxilla and mandible are underdeveloped

Late Childhood (6–12 years)

- Slower but steady growth
- Mixed dentition period
- Increase in facial height and length
- Nasal cavity and sinuses expand

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Phases of Facial Growth

Puberty (11–16 years)

- Most dramatic facial changes occur
- Surge in growth hormone and sex hormones
- Mandible grows faster and longer (especially in boys)
- Jaw alignment and bite patterns may change

Post-Puberty/Young Adult (16–21+ years)

- Growth slows down and eventually stops
- Subtle remodeling continues into mid-20s
- Third molars may erupt

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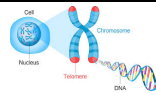
Genetics

Facial growth patterns:

- Some ethnic groups may be more prone to Class III skeletal patterns (e.g., East Asian populations).
- Tooth morphology and size:
 - Shovel-shaped incisors are more common in people of Asian and Native American ancestry.
 - African populations may have larger pulp chambers and denser alveolar bone.

Prevalence of malocclusion:

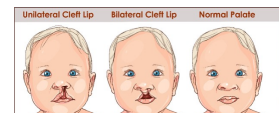
- Varies by population; for example, Class II malocclusions are more common in European populations.
- Jaw size and crowding:
 - Smaller jaws in some populations may lead to higher instances of crowding.



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Common Dental and Skeletal Disorders

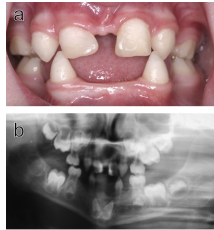
- Cleft lip and palate, Craniofacial anomalies (congenital anatomical differences)
- Down syndrome: often associated with macroglossia, delayed eruption, and periodontal vulnerability
- Ectodermal dysplasia: missing teeth, underdeveloped alveolar ridges
- Skeletal dysplasias: may affect jaw growth, airway size, and orthognathic planning



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Common Disorders

- Muscle weakness or spasticity (e.g., in cerebral palsy) can affect jaw alignment, chewing, and oral hygiene.
- Radiation therapy: may cause fibrosis, reduced salivary flow, or anatomical changes in the jaw.
- Osteoporosis or osteogenesis imperfecta: affects bone quality and healing.



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Abnormal Growth

Dental signs

- Severe crowding or spacing
- Delayed or asymmetric eruption
- Crossbites (anterior or posterior)
- Open bite or deep bite
- Class II or III molar/canine relationships
- Midline discrepancies

Soft tissue & functional signs

- Incompetent lips (lips remain open at rest)
- Mouth breathing
- Chin dimpling or mentalis strain on lip closure
- Tongue thrust or atypical swallowing
- Snoring or obstructive sleep apnoea symptoms
- Speech difficulties (e.g. lisping)

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Indications for assessment by an orthodontist

- Early loss or retention of primary teeth
- Signs of developing malocclusion (Class II/III, open bite, crossbite)
- Speech, airway, or facial asymmetry concerns
- Thumb-sucking or tongue habits beyond age 6
- Parent or patient concerns about jaw position or facial appearance

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Importance of understanding anatomical diversity

- Prevents clinical errors (e.g., missed root canals or surgical complications)
- Enhances communication and rapport
- Enables patient-specific treatment planning
- Promotes equitable and culturally competent care

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In Summary

Stages of Tooth Development:

- Initiation (6 weeks in utero): Tooth buds form.
- Bud, Cap, Bell Stages: Enamel and dentin begin to form.
- Apposition and Calcification: Hard tissues of teeth are deposited.
- Eruption: Teeth emerge into the mouth.
- Root Completion: After eruption, root formation finishes.

Tooth Eruption Timeline:

- Primary (baby) teeth: Erupt ~6 months to 2.5 years; 20 total.
- Permanent teeth: Begin around age 6; full set by age 12–13 (except third molars).

Dental Arch Growth:

- Jaw bones grow to accommodate larger permanent teeth.
- Mixed dentition stage (ages 6–12) is when both primary and permanent teeth coexist

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Summary of Facial Growth

Growth Centres:

- Skull grows mainly at sutures and at cartilage (e.g., nasal septum, condyle).
- Maxilla grows downward and forward.
- Mandible grows by appositional bone growth at the condyles and posterior ramus.

Growth Patterns:

- Follows a cephalocaudal gradient (head develops before lower face).
- Anterior-posterior and vertical growth continue into late teens.
- Mandibular growth typically continues longer than maxillary.

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Growth Summary

Growth Spurts:

- Key spurt during puberty (around 11–13 for girls, 13–15 for boys).
- Most facial growth completed by late teens, though small changes can occur into adulthood.
- Dental and facial growth are interrelated—teeth erupt in coordination with jaw development.
- Early or late growth patterns can impact orthodontic treatment timing.
- Understanding growth is crucial in pediatric dentistry, orthodontics, and oral surgery.