

# **Dental Anatomy/Occlusion Review for the NBDE Part I**

Presented by:

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# Overview

- 100 Questions
- Taken as part of the final 200 questions of the exam (second half of the day)
- May have some overlapping questions from Anatomy Section, ie. TMJ anatomy, muscles of mastication, etc.
- Useful resources: Dental Decks, old exam questions, Isselhard & Brand's *Anatomy of Orofacial Structures*, Kaplan Part I Review Book

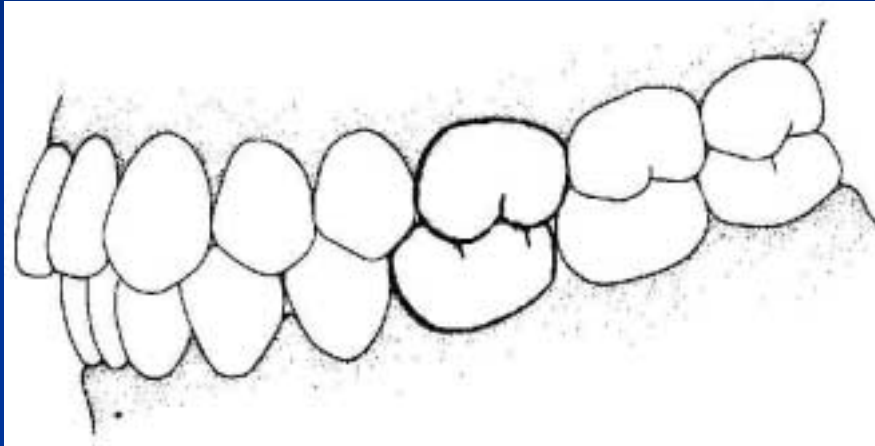
# Helpful Hint #1

- Write down everything on the margins of the exam booklet! (ie. tooth relationships, mnemonics, eruption schedules, primary and permanent teeth #s)
- Example:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
A B C D E					F G H I J										
T S R Q P					O N M L K										

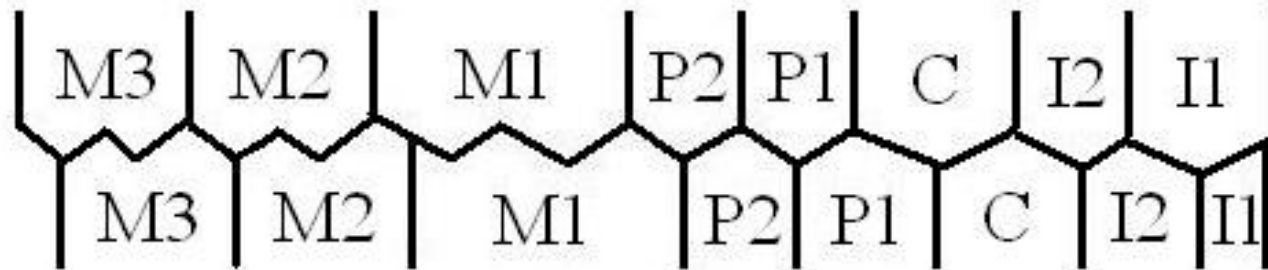
# Dental Arch Relationships

- The maxillary arch is usually LONGER than the mandibular arch



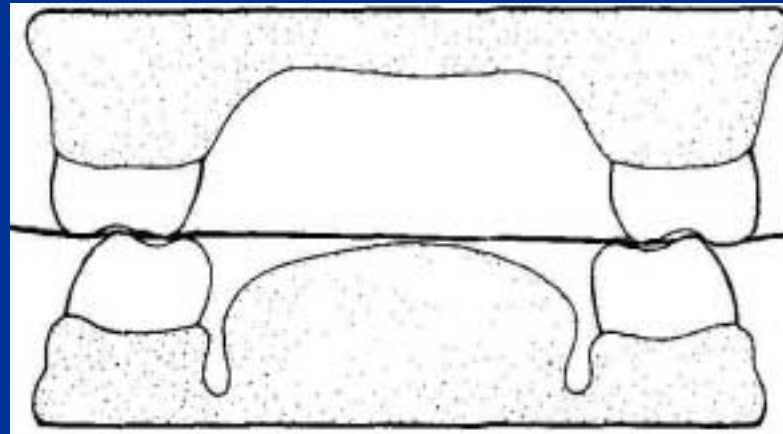
- What does this mean?
  - Every maxillary tooth is more DISTAL than its opposing counterpart, therefore:
    - 1) The only maxillary tooth with 1 opposing counterpart is the MAXILLARY THIRD MOLAR
    - 2) The only mandibular tooth with 1 opposing counterpart is the MANDIBULAR CENTRAL INCISOR

# Useful Diagrams



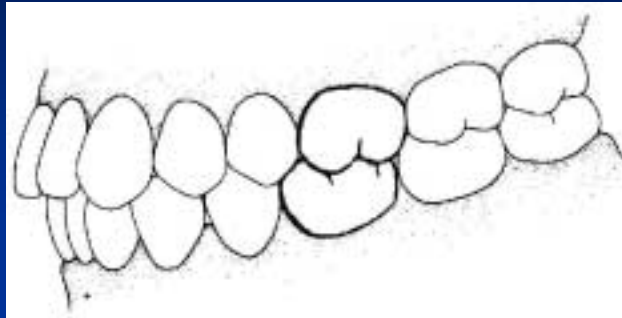
# Dental Arch Relationships

- The maxillary arch is usually **WIDER** than the mandibular arch



- Therefore, Supporting (functional) cusps are **MAXILLARY LINGUAL** and **MANDIBULAR BUCCAL** cusps
- Guiding (nonfunctional, shearing cusps) are **MAXILLARY BUCCAL** and **MANDIBULAR LINGUAL** cusps

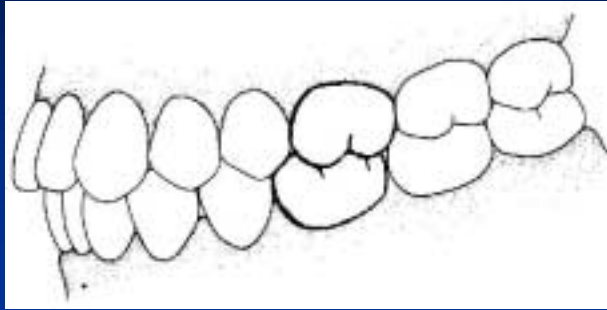
# Maxillary Cusps



- Buccal cusps:
  - Premolar cusps and the DB cusp of the maxillary molars overlap the embrasure between the counterpart and the tooth DISTAL to it, *except* for the maxillary 1<sup>st</sup> and 3<sup>rd</sup> molars (DB of maxillary 3<sup>rd</sup> molar only overlaps 1 tooth)
  - MB cusps of all maxillary molars overlap the counterpart's FACIAL groove (MESIOFACIAL groove for 1<sup>st</sup> molar, central groove for 2<sup>nd</sup> and 3<sup>rd</sup> molars)
  - DB cusp of maxillary 1<sup>st</sup> molar overlaps the DISTOFACIAL groove of the mandibular 1<sup>st</sup> molar
- Lingual cusps:
  - 2<sup>nd</sup> premolar cusp and the DL cusps of the maxillary molars contact the counterpart's distal marginal ridge and the mesial marginal ridge of the tooth DISTAL to it, *except* for the 1<sup>st</sup> premolar & DL cusp of the max. 3<sup>rd</sup> molar (only contact 1 marginal ridge respectively)
  - ML cusps of maxillary molars contact the counterpart's CENTRAL FOSSA
- Question: Which cusps are represented by the arrows?



# Mandibular Cusps



- Buccal cusps:
  - Premolar cusps and MB cusps of mandibular molars contact the mesial marginal ridge of the counterpart and the distal marginal ridge of the tooth MESIAL to it
  - The DB cusps of the mandibular molars contact the counterpart's CENTRAL FOSSA
  - The distal cusp of the mandibular 1<sup>st</sup> molar contacts the maxillary 1<sup>st</sup> molar's DISTAL PIT
- Lingual cusps:
  - Premolar cusps and ML cusps of mandibular molars overlap the embrasure between the counterpart and the tooth MESIAL to it
  - The DL cusps of the mandibular molars overlap the counterpart's LINGUAL GROOVE
- Question: Which cusps are represented by the arrows?





# Jaw Movements

- ONLY THE MANDIBULAR ARCH MOVES!!!!!!!!!!!!!!
- Working (laterotrusive) movement = towards the side that the mandible moves towards
- Non-working (mediotrusive, balancing) movement = NOT the side that the mandible moves towards
- Protrusion = moving the mandible forward in an anterior-posterior plane
- Retrusion = moving the mandible backwards in an anterior-posterior plane

# Jaw Movement Diagrams

- Which way is the mandible moving?
- Are the teeth on the side that the mandible is moving towards, or are they not?
- Isolate the teeth in question!

# Working movement



Right lateral (working side) movement



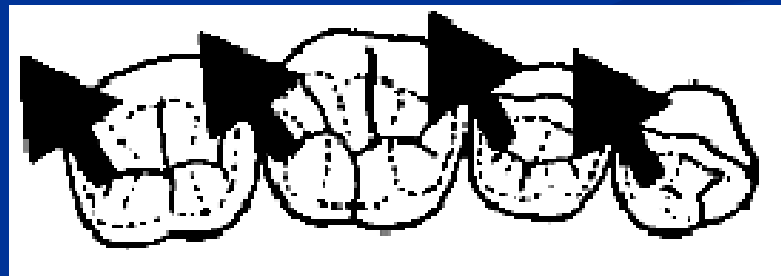
Right lateral (working side) movement

NOTICE MAXILLARY ARCH DOES NOT MOVE!! (Think in terms of where the mandible is moving in relation to the maxillary arch)

# Nonworking movement

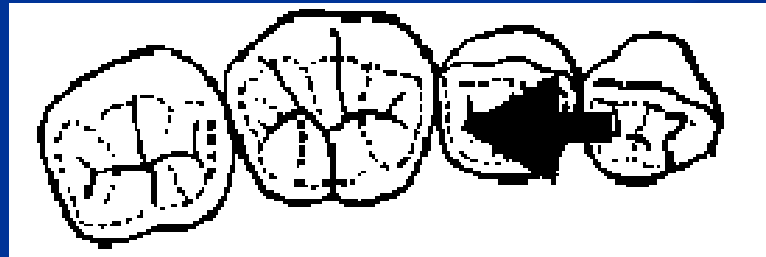


Left lateral (non-working) movement



Right lateral (non-working) movement

# Protrusion



# Mesio-Distal Contacts

(from facial view)

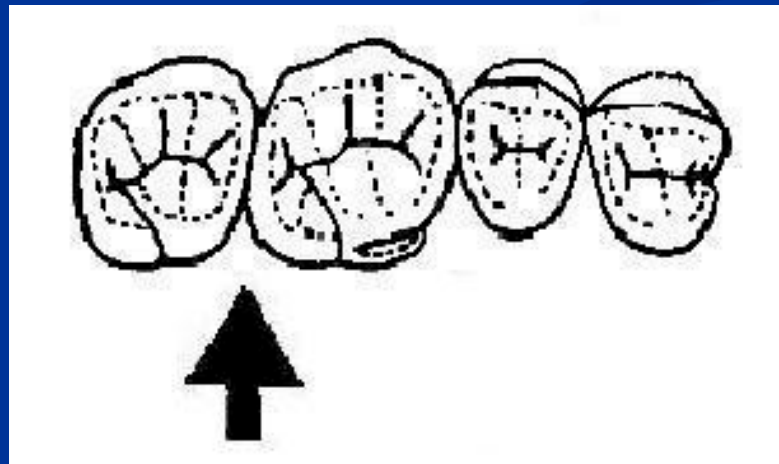
	Central Incisor	Lateral Incisor	Canine	Premolars	Molars
Maxillary	IJ	JJ	JM	JJ	MM
Mandibular	II	II	IM	JJ	MM

IJ means the MESIAL contact is located in the incisal third (I) while the DISTAL contact is located at the junction (J) of the incisal/occlusal and middle thirds.

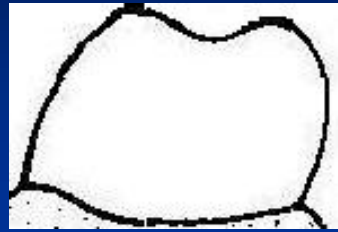
# Facio-Lingual Contacts

(from incisal/occlusal view)

- Facio-Lingual Contacts:
  - 1) CENTERED faciolingually for all ANTERIOR teeth
  - 2) SLIGHTLY BUCCAL of the middle third for all POSTERIOR teeth
- Facio-Lingual Embrasures: Every tooth has a wider LINGUAL embrasure than FACIAL embrasure EXCEPT for the lingual embrasure between the MAXILLARY 1<sup>st</sup> and 2<sup>nd</sup> MOLAR (less wide), and MANDIBULAR Anteriors



# Heights of Contour



- Located in the MIDDLE third of the crown on: LINGUAL surfaces of all posterior teeth (both maxillary & mandibular)
- Located in the CERVICAL third of the crown on: FACIAL surfaces of all posterior teeth, and FACIAL & LINGUAL surfaces of all anterior teeth



# Tooth Embryology

- 6<sup>th</sup> embryonic week = the oral (stratified squamous) epithelium begins thickening. This thickened oral epithelium is known as the **dental lamina**.
- 8<sup>th</sup> embryonic week = continued thickening in the dental lamina in 10 areas of the upper arch and 10 areas of the lower arch
- **Bud stage** = initial budding from the dental lamina at the 10 thickened areas in each arch (the first stage in the development of the **enamel organ**)
- **Cap stage** = consists of three components: outer enamel epithelium, inner enamel epithelium, and stellate reticulum
- **Bell stage** = fourth layer of epithelium, the stratum intermedium, appears between the IEE and the stellate reticulum. Two processes occur: (1) future outline or form of the crown of the tooth is determined (2) changes in IEE lead to production of dentin and enamel starting with IEE cells becoming taller → secretion of dentin matrix → secretion of enamel matrix → calcification of dentin → calcification of enamel.

# Tooth Embryology

- Terminology:

**Dental papilla** = forms the dentin and pulp of the tooth

**Dental sac** = forms the cementum of the tooth, the periodontal ligament, and some alveolar bone

**Hertwig's epithelial root sheath** = made up of OEE and IEE that determines the shape of the roots

# Primary vs. Permanent Teeth

- The crowns of the primary ANTERIOR teeth are *wider mesiodistally and shorter inciso-cervically* than their permanent successors.
- The crowns of the primary MOLARS are shorter and more narrow mesiodistally at the cervical third than the permanents. The root trunks of primary molars are also very short.
- The cervical ridge of enamel at the cervical third is much more prominent in primary teeth.
- The BUCCAL and LINGUAL surfaces of primary molars are flatter above the crest of contour than on permanent molars, giving the appearance of a narrower occlusal table.
- The enamel rods on primary teeth point OCCLUSALLY at the cervical third, compared to APICALLY for permanent teeth (which is why there is no need for a gingival bevel for a Class II amalgam on primary teeth).
- The roots of the primary are longer, more slender, and taper more rapidly than those of the permanent molars
- The pulp horns extend higher occlusally and the pulp chambers are proportionately larger in primary teeth.
- The primary teeth are LIGHTER in color than the permanent teeth.
- The MESIAL CUSP RIDGE is longer than the distal cusp ridge in the PRIMARY MAXILLARY CANINE (the opposite is true for all other canines).

# Eruption Schedule – Permanent (in years)

- Mandibular 1<sup>st</sup> Molar – 6
- Maxillary 1<sup>st</sup> Molar – 6
- Mand. Central Incisor – 6
- Max. Central Incisor – 7
- Mand. Lateral Incisor – 7
- Max. Lateral Incisor – 8
- Mand. Canine – 9
- Mand. 1<sup>st</sup> Premolar – 10
- Max. 1<sup>st</sup> Premolar – 10
- Mand. 2<sup>nd</sup> Premolar – 11
- Max. Canine – 11
- Mand. 2<sup>nd</sup> Molar – 12
- Max. 2<sup>nd</sup> Molar – 12
- Mand. 3<sup>rd</sup> Molar – 17-21
- Max. 3<sup>rd</sup> Molar – 17-21

# Eruption Schedule - Primary

- Central Incisor – 7 months
  - Lateral Incisor – 11 months
  - First Molar – 15 months
  - Canine – 19 months
  - Second Molar - 23 months
- \* **Rule of 4's** (every 4 months another one erupts)
- \* Mandibular teeth usually erupt before their maxillary counterpart.

# Dental Anomalies

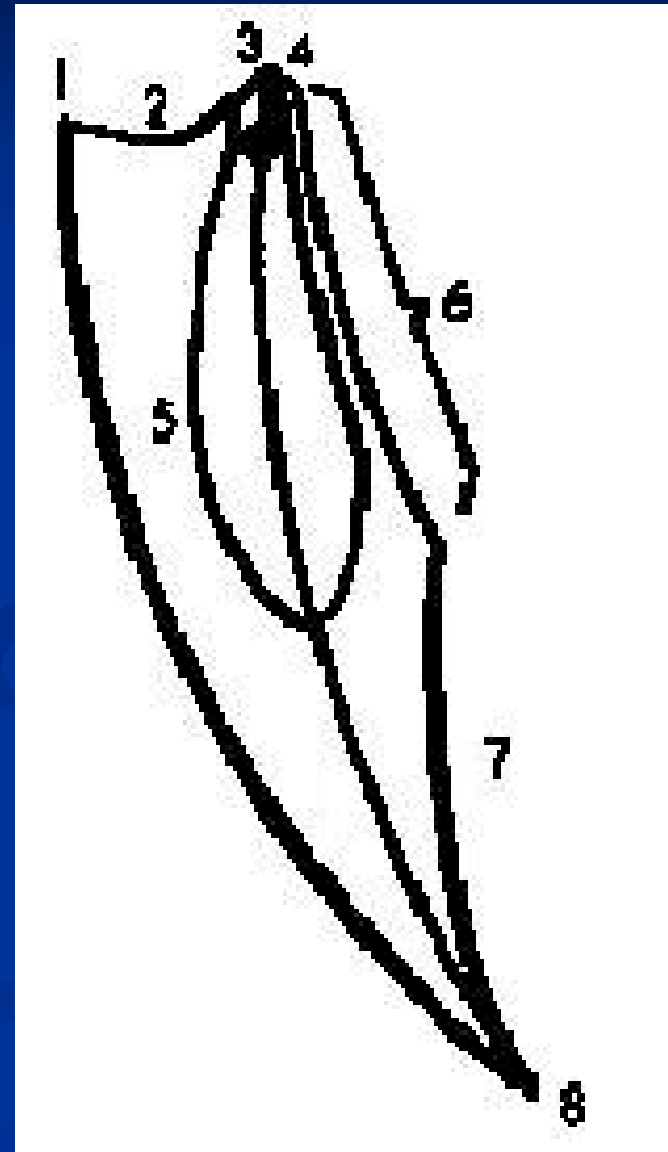
- Macrodontia = teeth are too large
- Microdontia = teeth are too small
- Hyperdontia = multiple or extra teeth (called supernumeraries)
- Anodontia = no teeth
- Dens in dente = outer surface of the tooth crown invaginates or turns itself inward before mineralization (most frequently affects **permanent maxillary lateral incisors**)
- Dilaceration = tooth that has a sharp bend or curve in the root or crown
- Gemination = tooth attempts to divide itself or partially twin itself by splitting its tooth germ
- Fusion = two adjacent tooth germs unite
- Concrescence = fusion of cementum of the roots
- Hypercementosis = deposition of excessive amounts of secondary cementum

# Dental Anomalies

- Enamel pearls = small masses of excess enamel on the surface of teeth located **APICALLY** to the CEJ
- Hutchinson's incisors & Mulberry molars = irregularly-shaped teeth as a result of **congenital syphilis**
- Enamel dysplasia = interruption of enamel formation
- Enamel hypocalcification = caused by a condition that inhibits the calcification of enamel
- Turner's tooth = hypocalcification of a single tooth, usually a maxillary incisor
- Enamel lamellae = cracks in the *enamel* caused by developmental problems or trauma
- Enamel tuft = small area of hypocalcified enamel seen *at the DEJ* and extending about one fourth to one third of the way through the enamel
- Enamel spindle = an **odontoblastic process** that ends up in the enamel

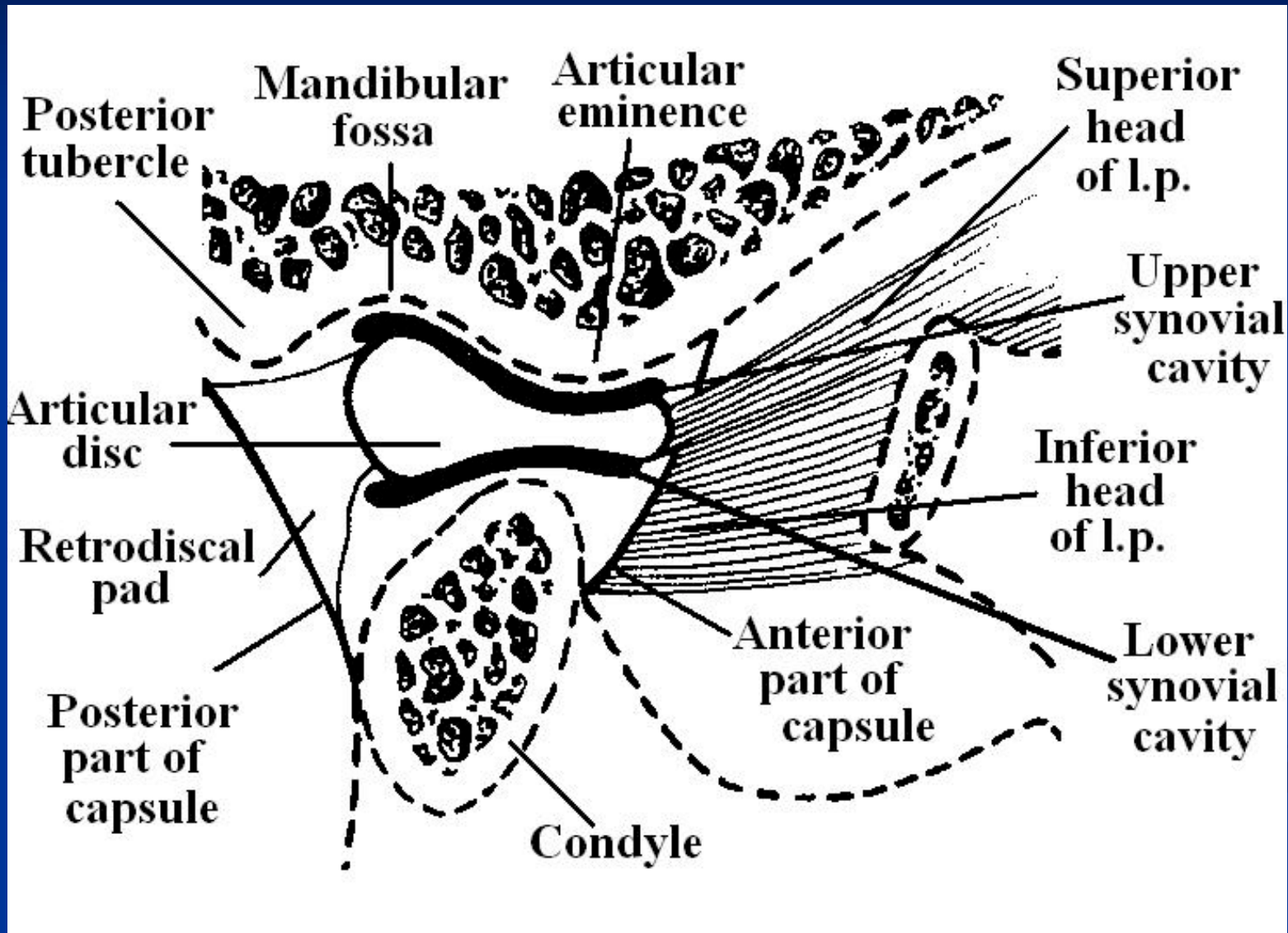
# Posselt's Envelope of Motion

- 1 = Maximum Protrusion (Protruded contact position)
- 2 = Edge to edge position of incisors
- 3 = Centric Occlusion (Maximum Intercuspatation)
- 4 = Centric Relation (Retruded contact position)
- Dot = Rest position
- 5 = Chewing stroke
- 6 = Rotation (Terminal Hinge Axis opening)
- 7 = Translation
- 8 = Maximum opening





# TMJ Anatomy



# TMJ Anatomy

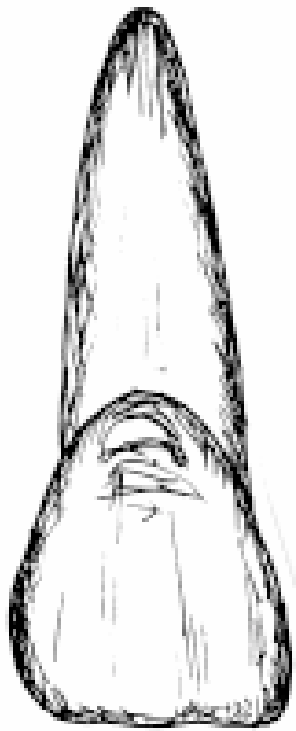
- Upper compartment (concavoconvex) = Space between articular disc and temporal bone. Permits TRANSLATIONAL movements.
- Lower compartment (concave) = Space between articular disc and mandibular condyle. Permits ROTATIONAL movements.
- Movement on opening = rotation occurs first, *then* translation
- The articular disc is **avascular** and is thickest at the posterior section, followed by the anterior, and thinnest in the middle
- The **retrodiscal pad** is an area where much of the blood and nerve supply to the joint is found

# Muscles of Mastication

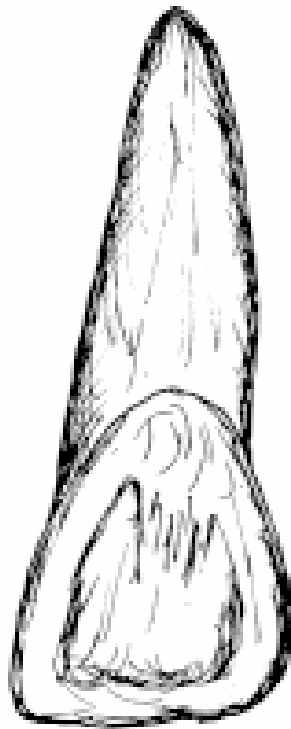
Muscle	Origin	Insertion
Masseter (superficial head)	Inferior border of the anterior two thirds of the zygomatic arch	Angle of the mandible on the lateral side
Masseter (deep head)	Inferior border of the posterior one third of the zygomatic arch and the entire medial side of the zygomatic arch	Lateral surface of ramus
Temporalis	Temporal fossa and temporal fascia	Coronoid process and anterior border of the ramus
Medial Pterygoid	Larger origin = medial side of the lateral pterygoid plate and pterygoid fossa & tiny area of the palatine bone Smaller origin = maxillary tuberosity	Medial surface of ramus and angle on the medial side
Lateral Pterygoid (superior head)	Infratemporal crest of the greater wing of the sphenoid bone	Capsule & articular disk of temporomandibular joint
Lateral Pterygoid (inferior head)	Lateral side of the lateral pterygoid plate	Neck of the condyle

# Maxillary Central Incisor Permanent

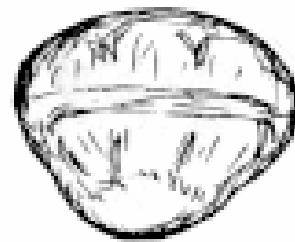
- Crown
  - Longest and widest anterior tooth
  - Crown wider mesial-distally (M-D) than Facial-Lingually (F-L)
- Root = one
  - Cervical dimension M-D approximately equal to F-L
- Surfaces
  - Mesial curvature of cervical line is largest
  - Cingulum located off-center toward distal
  - Narrowest incisal embrasures
  - 3 mamelons and 4 developmental grooves



**Labial**



**Lingual**



**Incisal**



**Mesial**

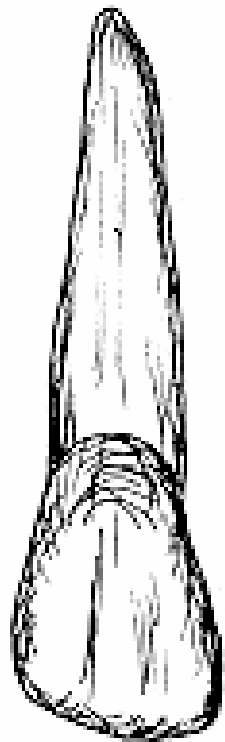


**Distal**

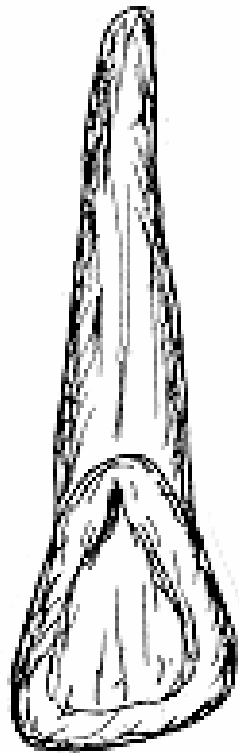
**Maxillary Right Permanent Central Incisor**

# Maxillary Lateral Incisor Permanent

- Crown
  - M-D > F-L (just like the max central incisor)
- Root
  - One, pointed apex, deviates to distal
- Surface
  - Lingual pit is common
  - Lingual surface most concave of any incisors
- Notes
  - May be congenitally absent
  - May appear pointed (“peg shaped”)



**Labial**



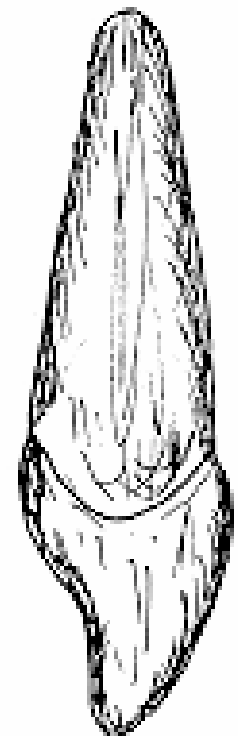
**Lingual**



**Incisal**



**Mesial**



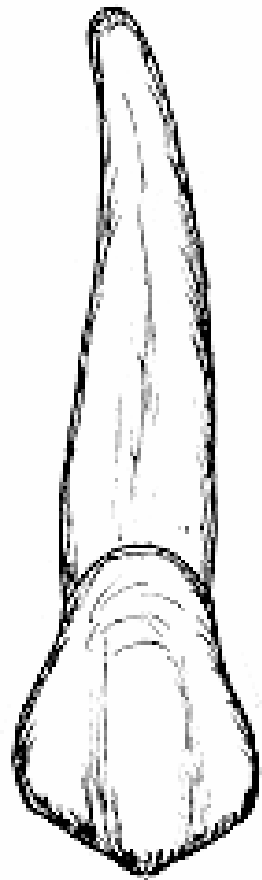
**Distal**

**Maxillary Right Permanent Lateral Incisor**

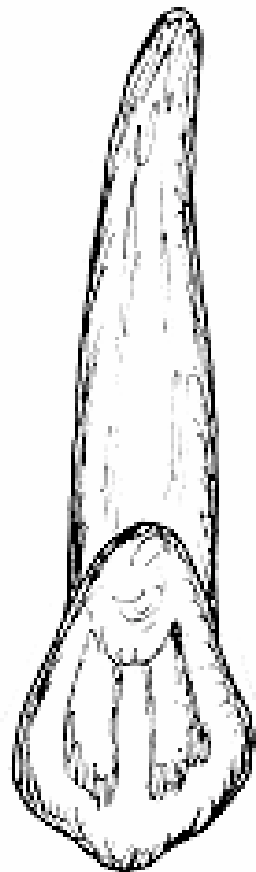
# Maxillary Canine Permanent

- Crown
  - Cingulum large and centered M-D
  - Wider F-L than M-D
- Root
  - Longest root
- Cusp
  - Mesial cusp ridge is shorter than distal cusp ridge
- Notes
  - Most stable and self cleansing tooth
  - Least often extracted tooth

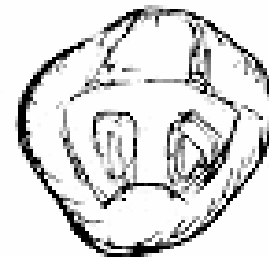




**Labial**



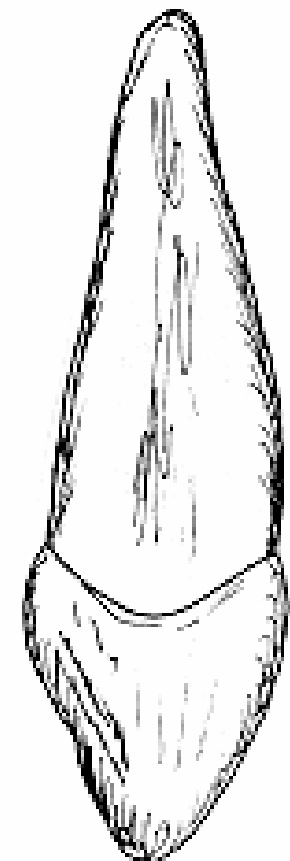
**Lingual**



**Incisal**



**Mesial**

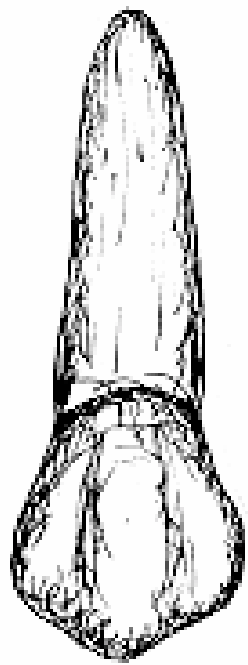


**Distal**

**Maxillary Right Permanent Canine**

# Maxillary First Premolar Permanent

- Crown
  - Widest of all premolars
  - Greater B-L than M-D
  - Longer occluso-gingivally than all posterior maxillary teeth
- Roots
  - 2 roots (only premolar with two roots)
- Cusps
  - Lingual cusp shorter than buccal cusp
  - Buccal cusp tip placed slightly distal
  - Mesial buccal cusp ridge is longer than distal buccal cusp ridge
  - Lingual cusp tip located toward mesial half of lingual surface
- Surface
  - Mesial surface has pronounced (deep) cervical concavity
- Occlusal
  - Long central groove, deep sulcus, no pits



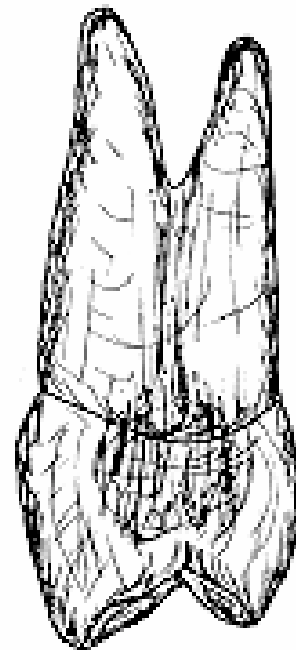
**Buccal**



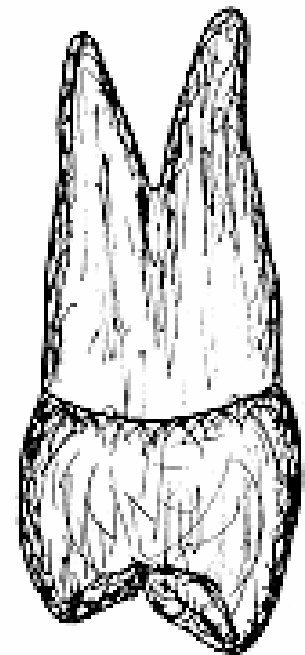
**Lingual**



**Occlusal**



**Mesial**



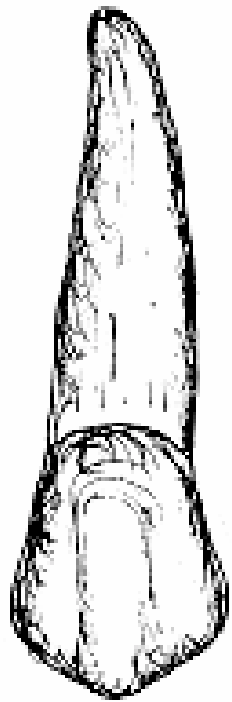
**Distal**

**Maxillary Right First Premolar**

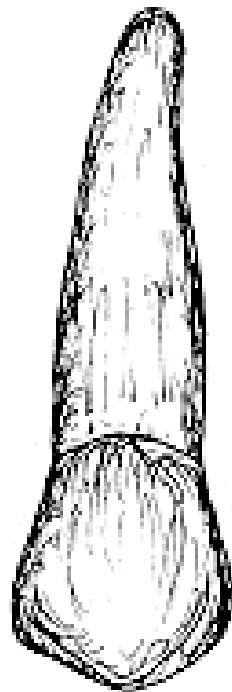
# Maxillary 2<sup>nd</sup> Premolar

## Permanent

- Crown
  - Smaller than maxillary 1<sup>st</sup> premolar
  - More symmetrical and less angular (more ovoid) than 1<sup>st</sup> premolar
- Root = one
- Cusp
  - Two cusps, buccal and lingual cusps are equal in height
  - Mesial inclination of lingual cusp
  - Distal buccal cusp ridge is longer than mesial buccal cusp ridge (opposite of maxillary first premolar)
- Surfaces
  - No mesial developmental depression
  - Less prominent buccal ridge
- Occlusal pattern
  - Shorter central groove with more supplemental grooves



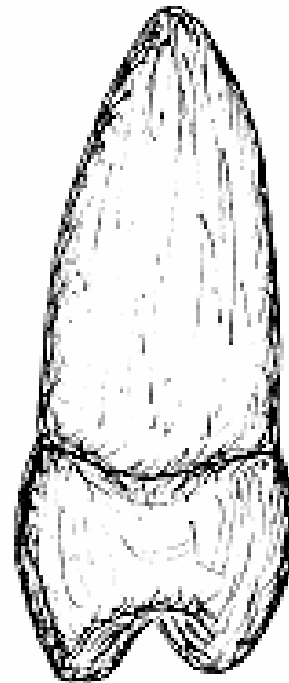
**Buccal**



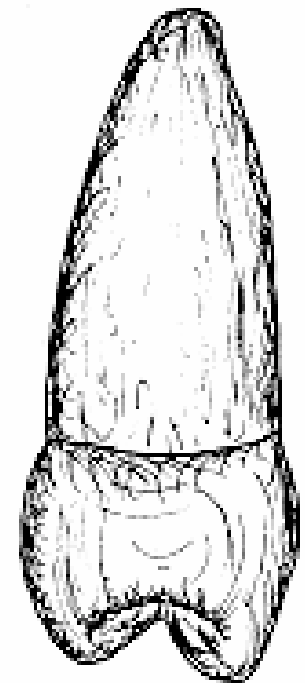
**Lingual**



**Occlusal**



**Mesial**



**Distal**

**Maxillary Right Second Premolar**

# Maxillary 1<sup>st</sup> Molar

## Permanent

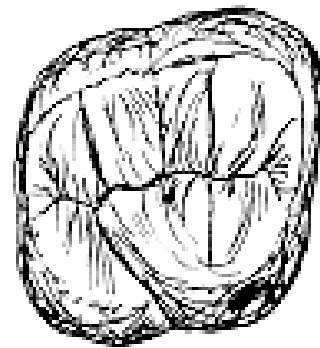
- Crown
  - Largest permanent tooth
  - Broader lingually than buccally
- Roots = 3
- Cusps
  - 4 (2 buccal, 2 lingual)
  - Mesial-lingual always largest and highest on any posterior tooth
  - Cusp of carabelli seen lingual to mesial-lingual cusp
  - Mesial-buccal longer and wider than Distal-buccal
- Occlusal
  - Oblique ridge connects the mesial-lingual cusp and distal-buccal cusp
  - Occlusal view of all maxillary molars = rhomboidal shape
  - Rhomboidal shaped occlusal view with obtuse angles at mesial-lingual and distal-buccal
- Surface
  - Distal surface – pronounced cervical concavity
  - Long buccal groove with pit



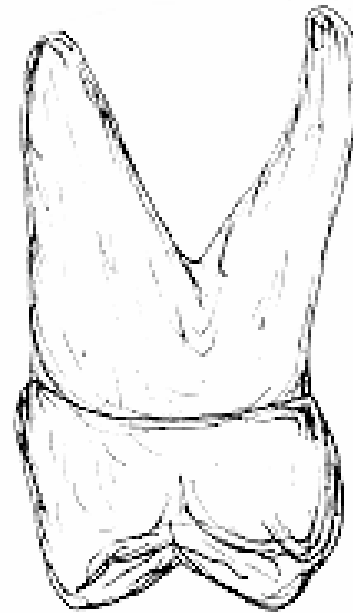
**Buccal**



**Lingual**



**Occlusal**



**Mesial**



**Distal**

**Maxillary Right First Permanent Molar**

# Maxillary 2<sup>nd</sup> Molar

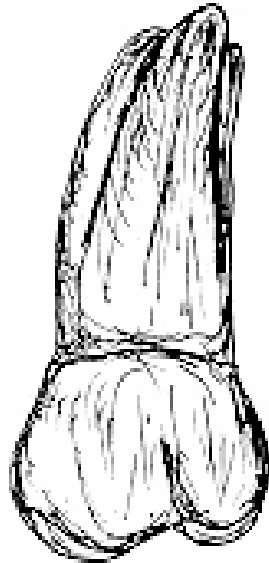
## Permanent

- Crown
  - Smaller than 1<sup>st</sup> molar
  - Mesial-facial line angle most acute
  - Absence of 5<sup>th</sup> cusp (Carabelli)
- Root = 3
- Cusp
  - mesial-lingual cusp largest
  - Primary cusp triangle = mesial-lingual, mesial-buccal, and distal-buccal cusps (same for all maxillary molars)
  - Buccal groove does not have a pit
- Notes
  - Small distal-lingual cusp that can be absent creating a 3 cusp tooth





**Buccal**



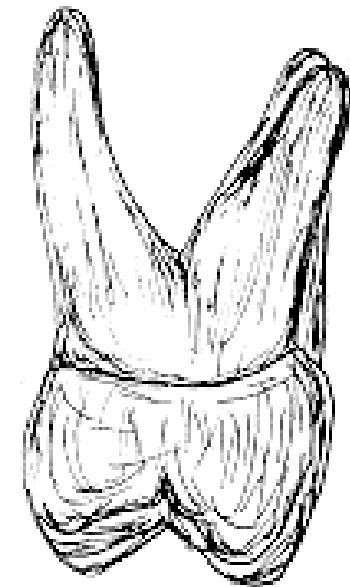
**Lingual**



**Occlusal**



**Mesial**

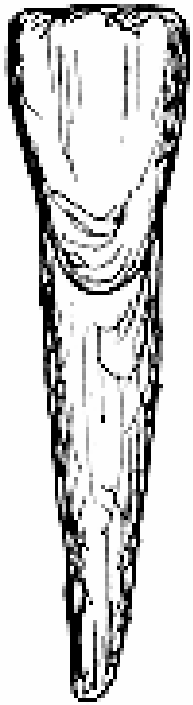


**Distal**

**Maxillary Right Second Permanent Molar**

# Mandibular Central Incisor Permanent

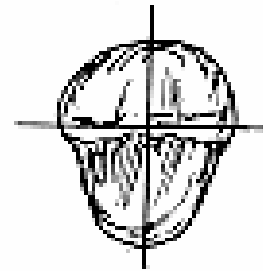
- **Crown**
  - Nearly bilaterally symmetrical
  - Mesial-incisal and distal-incisal angles are sharp, nearly at right angles
- **Root = one**
  - Thin M-D and wide F-L
  - Mesial and distal surface concave (also present on mandibular laterals)
- **Surface**
  - Cingulum – centered
  - Lingual surface smooth and shallow
  - No grooves, accessory ridges or pits
- **Notes**
  - Mesial and distal contacts are exactly the same area of the incisal third (unique to mandibular central incisors)



**Labial**



**Lingual**



**Incisal**



**Mesial**



**Distal**

**Mandibular Right Permanent Central Incisor**

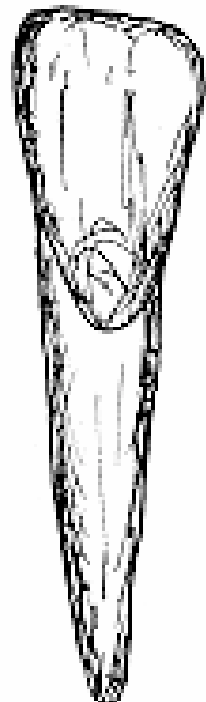
# Mandibular Lateral Incisors

## Permanent

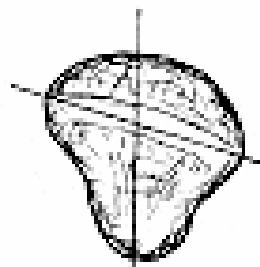
- Crown
  - Tilted distally on the root
  - Broader labiolingually than mesiodistally
- Root = one
  - Narrow M-D
  - Concavities on M-D surfaces
- Surfaces
  - Cingulum off-center to the distal
  - Mesial marginal ridge is slightly longer than distal marginal ridge



**Labial**



**Lingual**



**Incisal**



**Mesial**



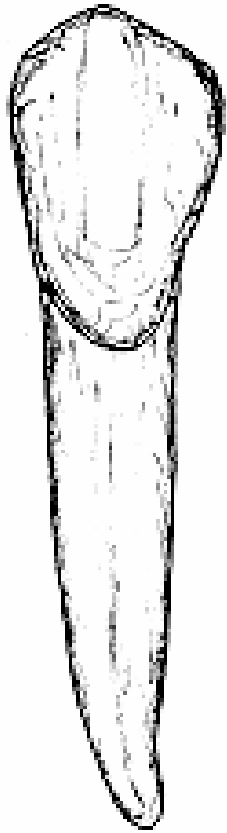
**Distal**

**Mandibular Right Permanent Lateral Incisor**

# Mandibular Canine

## Permanent

- Crown
  - Longest crown of all permanent teeth
  - F-L > M-D
- Root = one
  - May be bifurcated
- Cusp
  - Cusp tip displaced lingually
  - Mesial cusp ridge shorter than distal cusp ridge (just like maxillary canine)
- Surfaces
  - Mesial surface of crown almost parallel to long axis of tooth



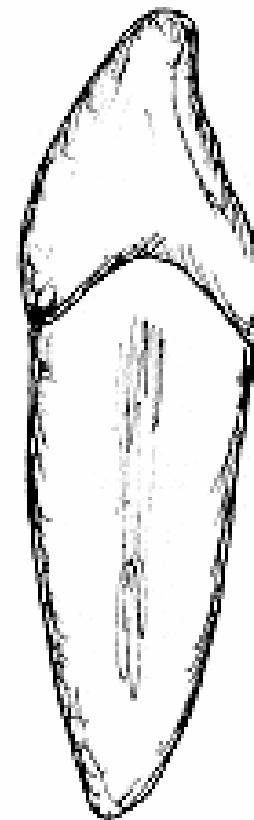
**Labial**



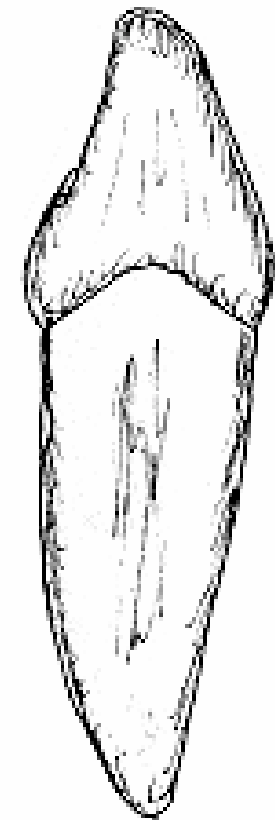
**Lingual**



**Incisal**



**Mesial**



**Distal**

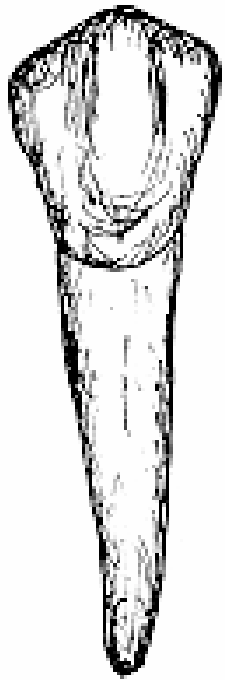
**Mandibular Right Permanent Canine**

# Mandibular 1<sup>st</sup> Premolar

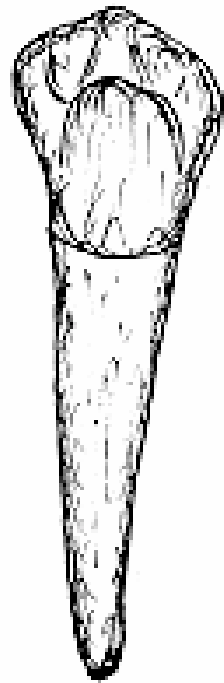
## Permanent

- Crown
  - More prominent buccal ridge than 2<sup>nd</sup> premolar
  - Bell shaped crown
- Root = one
  - Pointed apex
  - No distal curvature
  - Many have concavities on mesial and distal
- Cusp
  - Large pointed buccal cusp
  - Small nonfunctioning lingual cusp
  - High buccal and low lingual pulp horns
- Occlusal pattern
  - Small, nonfunctioning
  - Usually no central groove

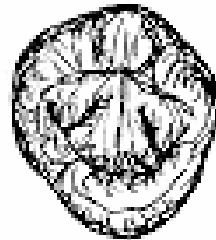




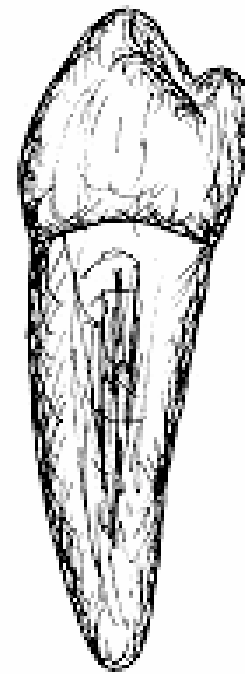
**Buccal**



**Lingual**



**Occlusal**



**Mesial**



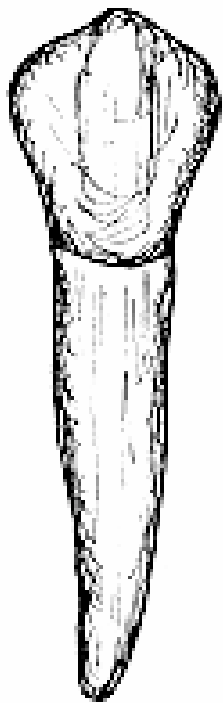
**Distal**

**Mandibular Right First Premolar**

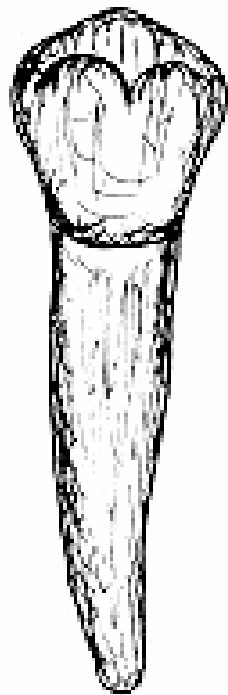
# Mandibular 2<sup>nd</sup> Premolar

## Permanent

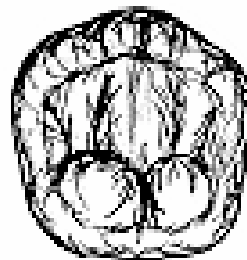
- Crown
  - 5 lobes (Y type) 3 cusps, one buccal and 2 ling
  - Square occlusal outline
- Root = one
  - Apex approximates mental foramen
  - Thicker and longer than mandibular 1<sup>st</sup> premolar
- Cusp
  - Mesial-lingual cusp always larger than distal-lingual cusp
- Pits and grooves
  - Central developmental groove “U” shaped or like a crescent
  - Mesial-distal fossae
- Occlusal pattern
  - Larger occlusal surface than 1<sup>st</sup> mandibular premolar
  - No mesial-lingual groove or transverse ridge (common on 1<sup>st</sup> mandibular premolars)
  - 3 types of occlusal surface = Y, H, U type



**Buccal**



**Lingual**



**Occlusal**



**Mesial**



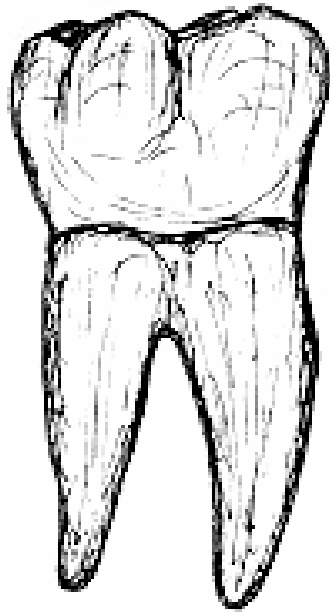
**Distal**

**Mandibular Right Second Premolar**

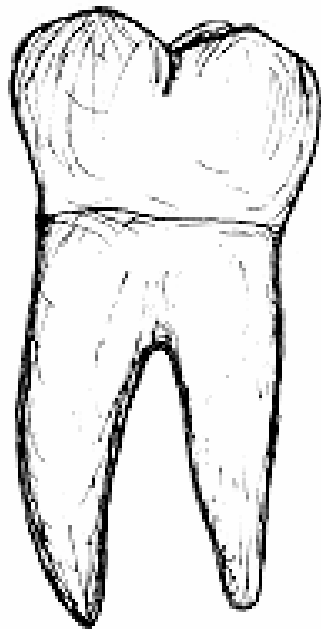
# Mandibular 1<sup>st</sup> Molar

## Permanent

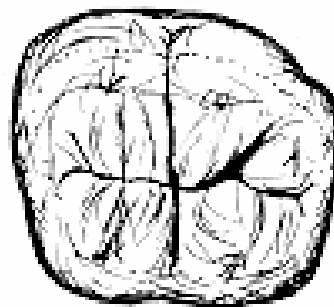
- Crown
  - Largest mandibular tooth
  - Largest mesial-distal dimension of any tooth
  - Occlusal outline = similar to a trapezoid
- Root = 2
  - Two roots with 3 canals (2<sup>nd</sup> canal in mesial root)
- Cusps
  - 5 (3buccal; 2 lingual), mesial-buccal cusp is largest
  - Distal cusp = smallest
  - Lingual cusp are higher and more pointed (non-supporting) than buccal cusp (supporting)
- Occlusal pattern
  - 2 transverse ridges, 3 fossae with pits
  - Central groove crooked
  - 2 buccal grooves



**Buccal**



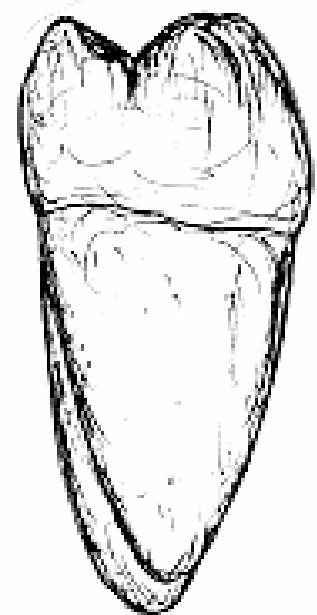
**Lingual**



**Occlusal**



**Mesial**



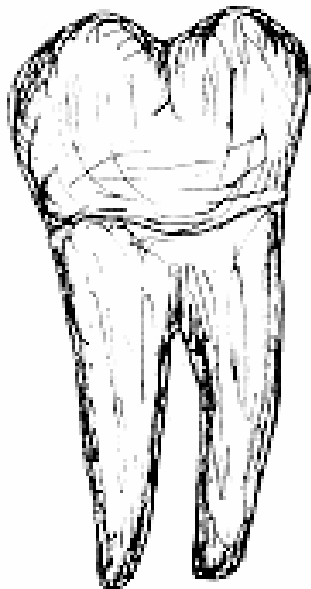
**Distal**

**Mandibular Right First Permanent Molar**

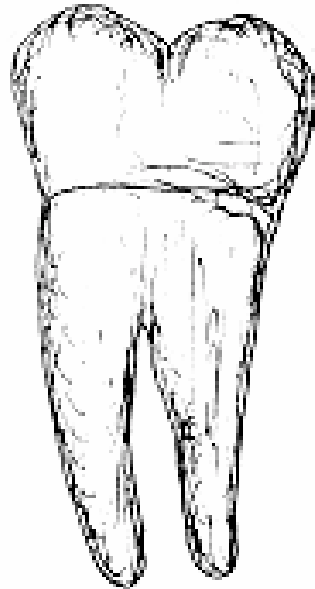
# Mandibular 2<sup>nd</sup> Molar

## Permanent

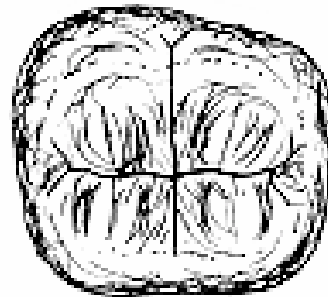
- Crown
  - Occlusal outline is rectangular
- Roots = 2
  - Closer together and straighter than first mandibular molar roots
  - Mesial root not as broad F-L compared to 1<sup>st</sup> mandibular molar
  - Longer root trunk than mandibular 1<sup>st</sup> molar
  - Apices are located inferiorly to mylohyoid muscle insertion
- Cusps = 4
- Occlusal pattern
  - Plus sign (+)
  - More secondary developmental grooves than 1<sup>st</sup> mandibular molar
  - 2 transverse ridges
  - 3 fossae with pits
- Buccal groove with buccal pit



**Buccal**



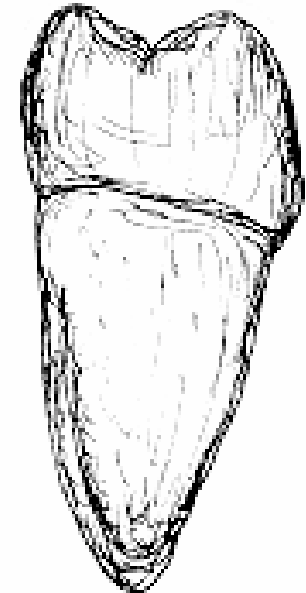
**Lingual**



**Occlusal**



**Mesial**



**Distal**

**Mandibular Right Second Permanent Molar**