

Definitions and terminology

Every cusp has 4 ridges: Medial, Facial, Distal, Buccal

Cingulum:

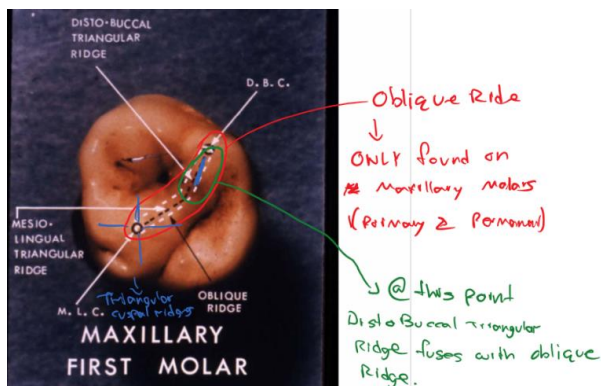
-Incisors and Canines #23

Mamelons:

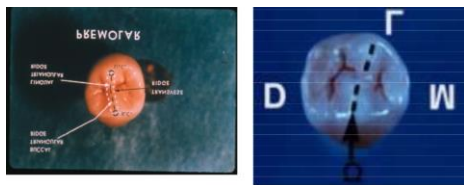
- Not in primary incisors
- Bumps on incisal edge of incisors
- Eventually get worn down and smooth

Ridges:

Oblique Ridge – Union of 2 ridges running diagonally across surface of MAXILLARY MOLARS. Meeting of distal ridge of mesiolingual cusp and triangular ridge of distofacial cusp

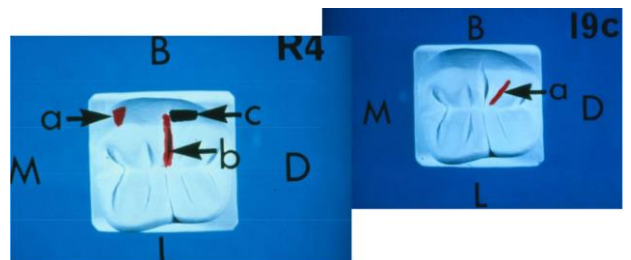


Transverse Ridge – fusion of 2 triangular ridges across from each other



Developmental Grooves – Deep depressions separating cusps

Accessory/supplemental grooves – shallow depressions on cuspal slopes



Dental Morphology Review

Fossae – Irregular depressions (usually around marginal ridge)

Pits – pinpoint depressions at junction or at terminal of developmental grooves.

Tooth Deflection Theory – Convexities of teeth (height of contour) and embrasure deflects food away from soft tissue

Anterior Aesthetic

- Everyone's teeth are different shapes and sizes. There isn't really a set SIZE. But there are general trends.
- Embrasures increase in size as we go from central incisors to canines
- GOLDEN PROPORTIONS = 1:0.618 (so lateral incisors are 61.8% the size of central incisors)

Average length:

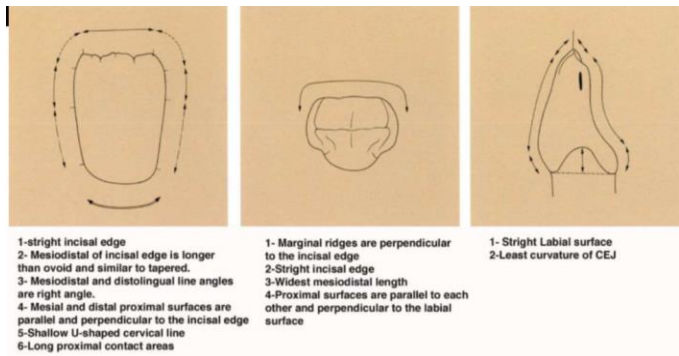
Maxillary Central: 11mm (proportionally balanced when Crown width is 0.75-0.8 of its length)

Maxillary Canine: 13mm

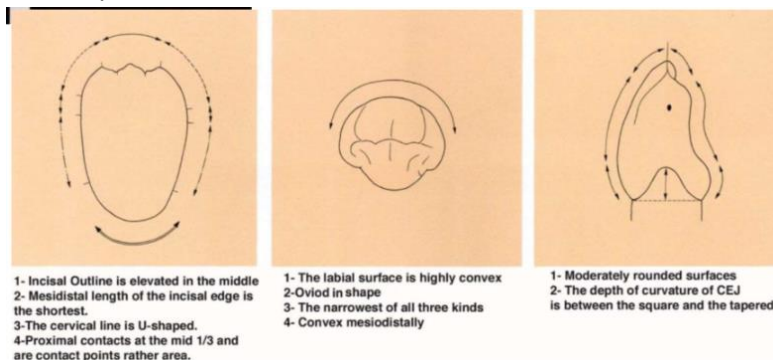
Maxillary Lateral: 10mm

Shapes:

Square-Cube

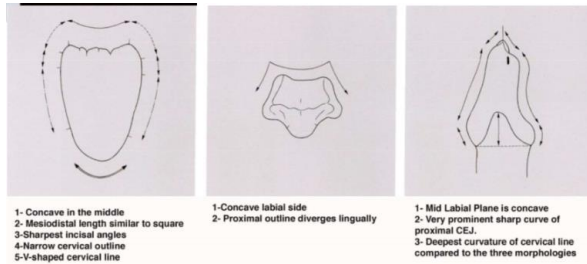


Ovoid-Sphere



Dental Morphology Review

Tapered-Pyramid



Permanent Eruption Sequence

Age	Tooth Eruption
6-7	1 st Molar
7-8	Central Incisor (11, 21, 31, 41)
8-9	Lateral Incisors (12, 22, 32, 42)
9-10	Canines
10-11	1 st Premolar (bicuspid), Maxillary
10-12	2 nd Premolar Maxillary, 1 st Premolar Mandibular
11-12	2 nd Premolar mandibular
12-13	2 nd Molar
17-21	3 rd Molar (wisdom tooth)

Primary Eruption Sequence

Months	Maxillary	Mandibular
6		1
8	1	
10		2
12	2	
14		4
16	4	
18		3
20	3	
22		5
24	5	

Incisors

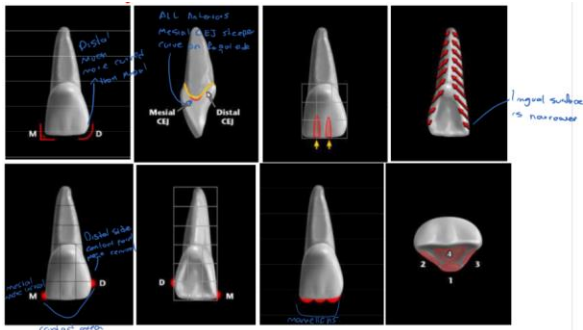
Maxillary Central Incisors

- Trapezoid or quadrilateral crown shapes
- Mamelons in permanent teeth
- Longer Inciso-gingivally (vertical dimension) than mesio-distally (horizontal dimension)
- Mesio-incisal angle more square, disto-incisal angle more obtuse and rounded

Dental Morphology Review

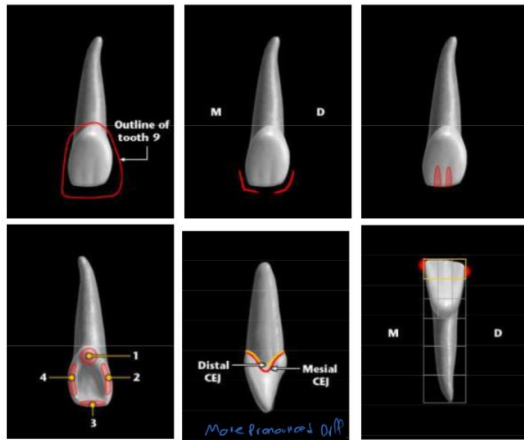
- Crowns taper from proximal contact towards lingual
- Mesial and distal marginal ridges converge towards cingulum

Mesial	Distal
Deeper contour of CEJ	Shallower contour of CEL
More acute, sharper incisal angle	Obtuse rounded incisal angle
Contact in incisal third	Contact more cervical than mesial



Maxillary Lateral Incisors

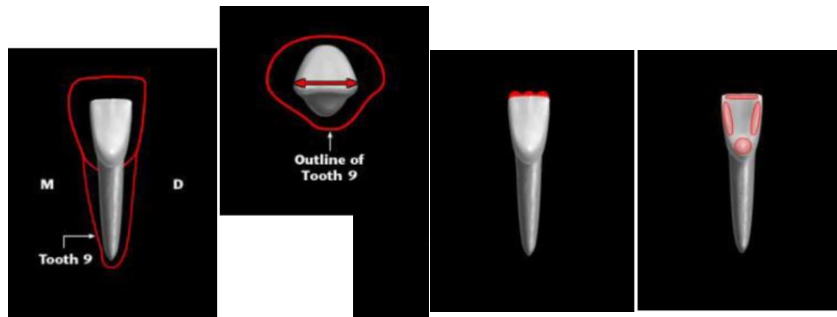
- Smaller and more exaggerated curvature than centrals
 - o Accounts for larger embrasure space
- More square shape
- Might have lingual pit on cingulum



Mandibular Central Incisors

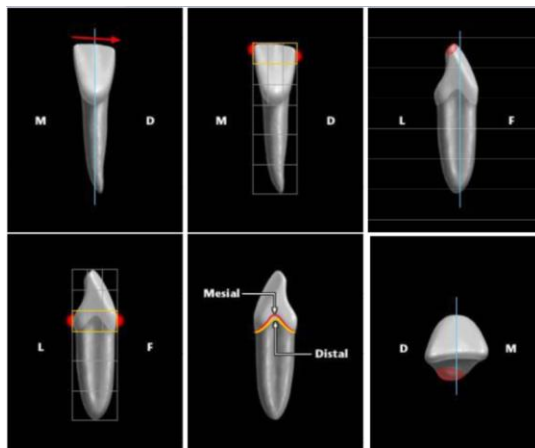
- Much more symmetrical, so have to use CEJ curvature to determine L or R
 - o Mesial dips deeper than Distal
- Curve a bit more lingually (allows maxillary space for occlusion)
- **Smallest tooth in mouth**
- Wedge shape (like all incisors)
- Less prominent lingual ridges (compared with maxillary incisors)
- No lingual pit
- Shallower lingual fossa

Dental Morphology Review



Mandibular Lateral Incisor

- Slight distal twist
- Slight down incisal angle down to distal corner



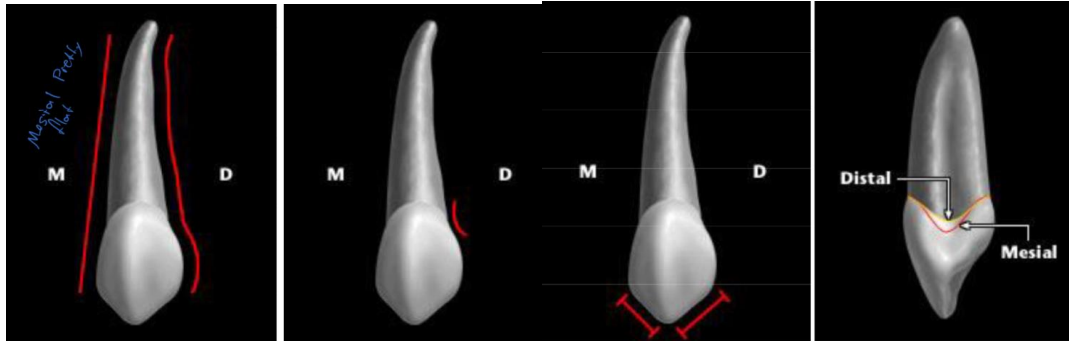
Canines:

- Longest roots of all teeth (almost to base of nose!), 29mm
- Few developmental grooves/pits
- Hard to remove
- Prominent cingulum
- Narrower crown mesio-distally than central incisors
- Cusp tip instead of incisal edge
- Middle labial lobe (ridge off of cusp)

Maxillary

- Pentagonal shape
- One cusp
- Distal Concavity
- Distal cuspal ridge longer than mesial (has to reach down to premolars)
- 3 Ridges on lingual side (mesio-lingual, disto-lingual, and lingual)
- Pronounced cingulum and labial cuspal ridge
- Narrower mesio-distally at lingual compared to facial

Dental Morphology Review

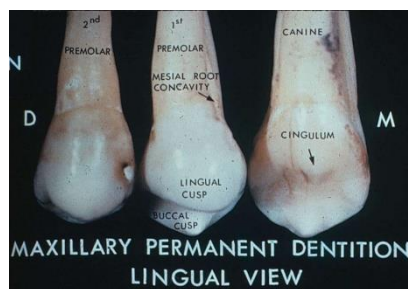
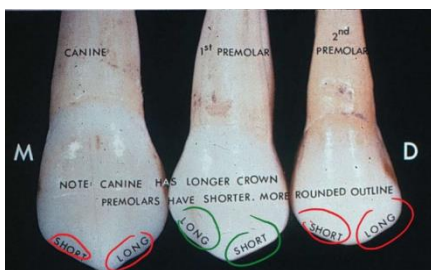


Mandibular:

- Slightly narrower than maxillary
- Almost straight mesial outline (like maxillary)
- Longer distal cuspal ridge than mesial
- Less prominent lingual features than maxillary
- Cuspal tip towards lingual

Premolars (bicuspid)

- Most have 2 cusps (except Mandibular 2nd premolar)
- Mesial proximal contacts near junction of occlusal and middle thirds
 - o Distal contacts slightly more cervical in middle third
- Roughly pentagonal
- Mesial cuspal ridge of buccal cusp shorter than distal cuspal ridge (Except 1st premolar)
- Crowns wider faciolingually than mesiodistally

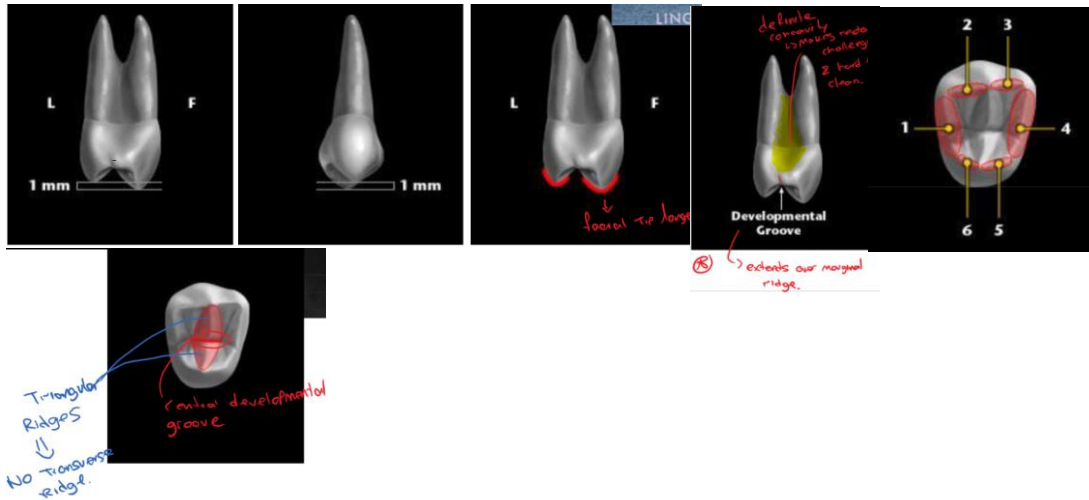


Maxillary 1st Premolars:

- Slightly shorter than canine, pentagonal (looks like a small canine)
- Mesial cuspal ridge longer than distal cuspal ridge
- Mesial Cuspal ridge is straight, distal cuspal ridge convex
- Facial cuspal tip is pointed, Lingual cuspal tip is rounded
- Height of contour in cervical third
- Lingual cusps is shorter
- Tip of facial cusp is distal to long axis (not fully symmetric)
- Lingual cusp is tipped mesial

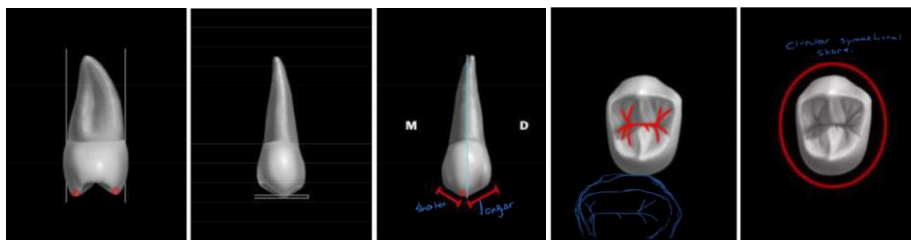
Dental Morphology Review

- **Mesial marginal groove breaks through marginal ridge** to mesial surface
- NO accessory grooves
- **MESIAL ROOT CONCAVITY**, leads to issues with cleaning
- Square shape occlusally



Maxillary 2nd Premolars

- Same size as maxillary first Premolar
- Facial and lingual cusps same length (and quite rounded).
- Because facial cusp lacks point, its shorter than 1st premolar facial cusp
- Less distinctive occlusal groove patten
- Presence of shallow linear accessory grooves
- Less curvature of mesial surface under contact
- Rounded shape from occlusal view
- Mesial cuspal ridge shorter than Distal (opposite of 1st premolar)

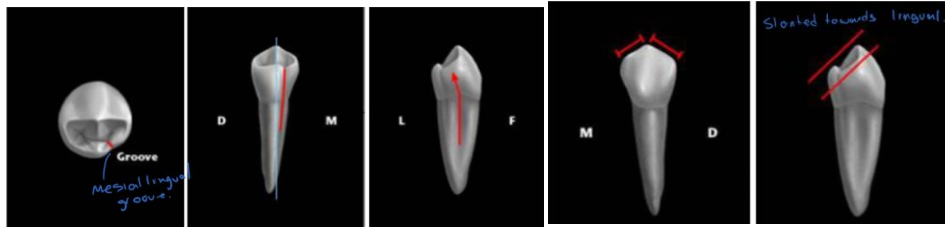


Mandibular 1st Premolar:

- Mesial cuspal ridge shorter than distal cuspal ridge
- VERY short lingual cusp, almost like a cingulum
- Facial cusp is largest, and the only functional one
- Prominent transverse ridge

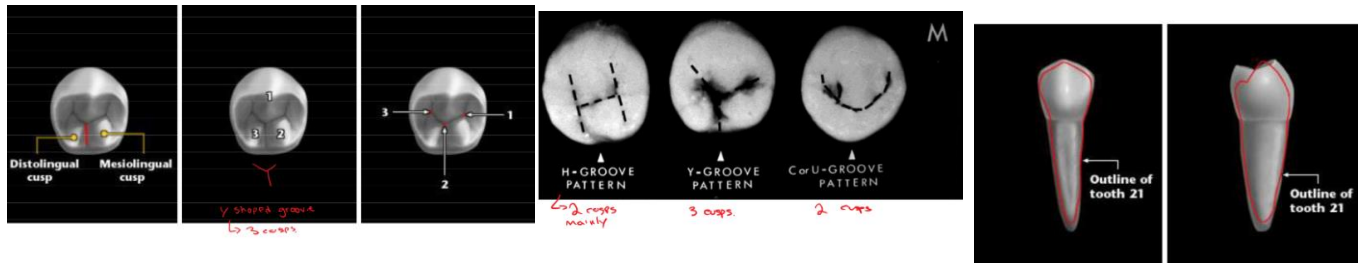
Dental Morphology Review

- Triangular occlusal table
- Mesiolingual groove separates mesial ridge from lingual cusp, and extends onto root structure
- Facial cusp slanted to lingual side
- **Transverse ridge between facial and lingual cusps**



Mandibular 2nd Premolar

- Square occlusal view
- Y, H, U shaped occlusal groove pattern. H and Y are most common, U is least common.
- 3 cusps (Facial largest, distolingual is smallest), and 3 pits. Unless H then only 4 cusps
- Slightly shorter facial cusp compared to 1st premolar
- Doesn't curve lingually as much as 1st premolar
- Less distinct distal concavity



Molars

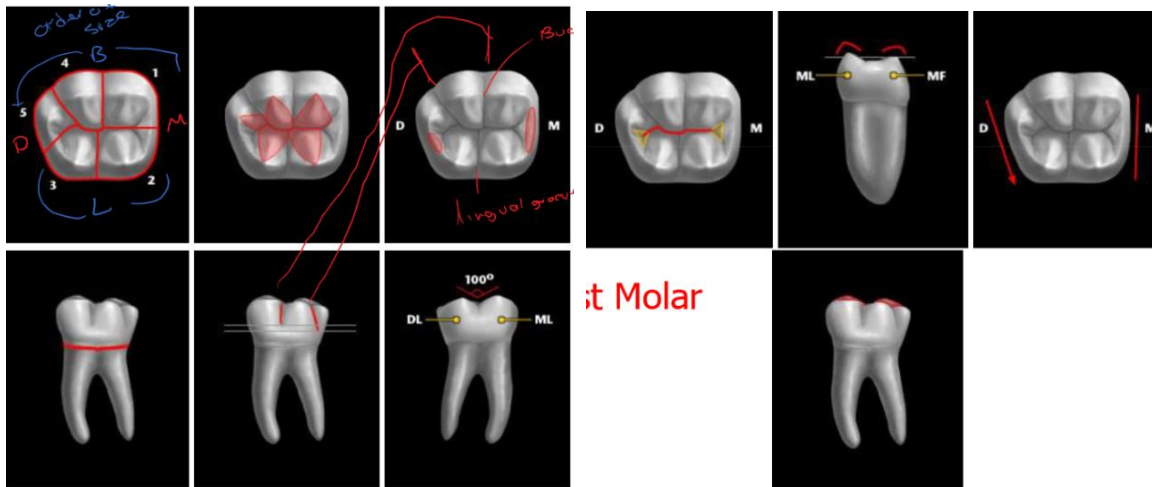
- Maintain vertical dimension of face
- Grind food
- Mandibular molars = 51% of arch

Dental Morphology Review

- Maxillary Molars = 44% of arch
- 1st molars are first permanent teeth to erupt
- 1st molars larger than 2nd and 3rd
- Shallower groove pattern, more accessory grooves in 2nd and 3rd
- Roots fuse and incline distally
- 3 ROOTS
- Crowns become shorter as move from 1st to 3rd molar

Mandibular 1st molar

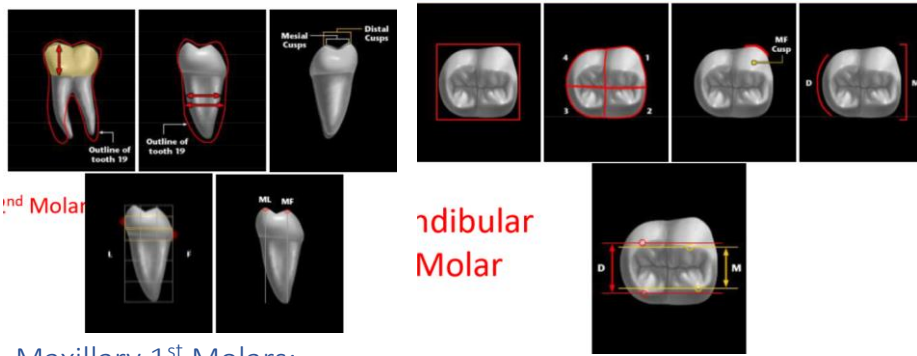
- Largest in mandibular arch
- 5 lobes, 5 cusps
- Widest = mesiofacial
- Longest = Mesiolingual
- Shortest = distal
- Wider mesiodistally than maxillary (which are wider faciolingually)
- NO OBLIQUE RIDGE
- 2 Developmental grooves on facial (distal facial, and facial)



Mandibular 2nd Molar:

- Smaller crown
- 4 cusps equal in size
- Faciolingual is broader at mesial
- Shallower central fossa than 1st molar
- Less convergence to lingual than 1st molar
- Height of contour on lingual side is at top of middle third, on facial side is middle of the cervical third

Dental Morphology Review

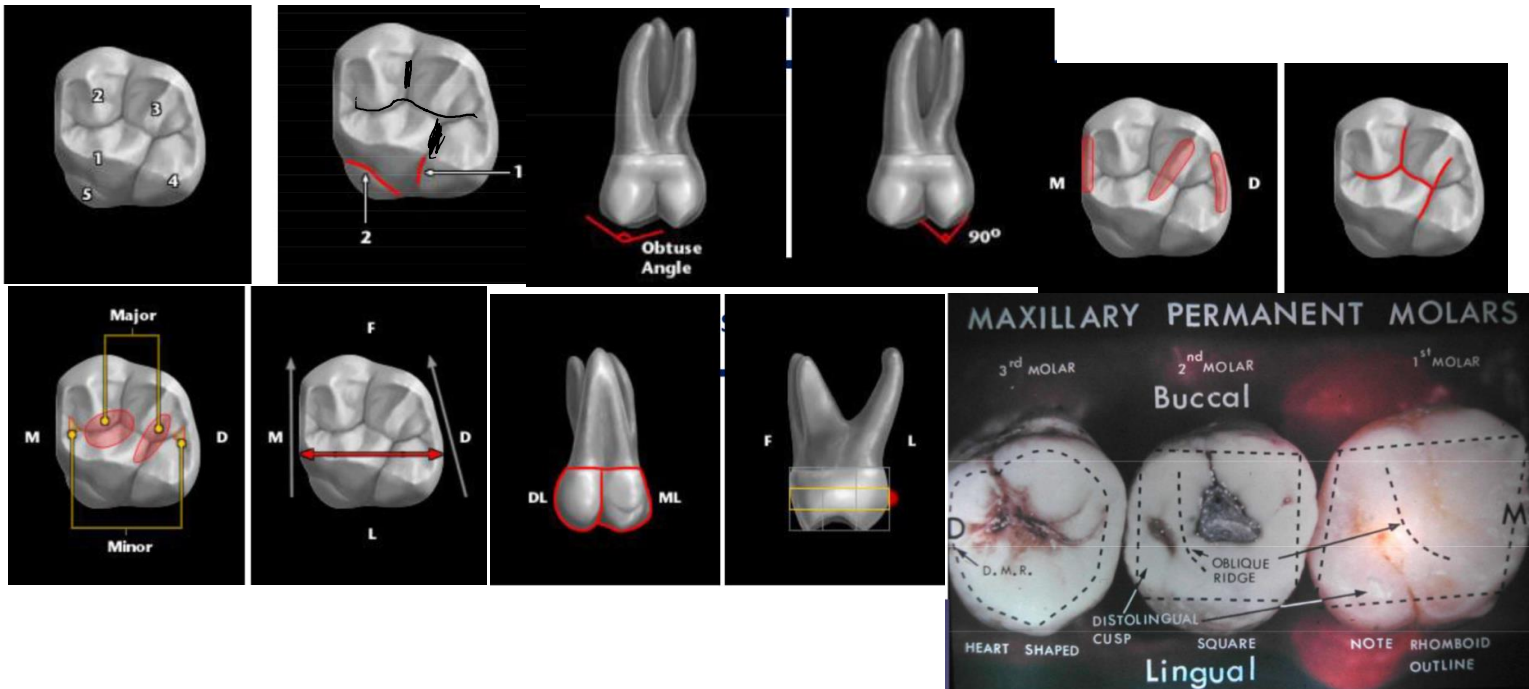


2nd Molar

mandibular Molar

Maxillary 1st Molars:

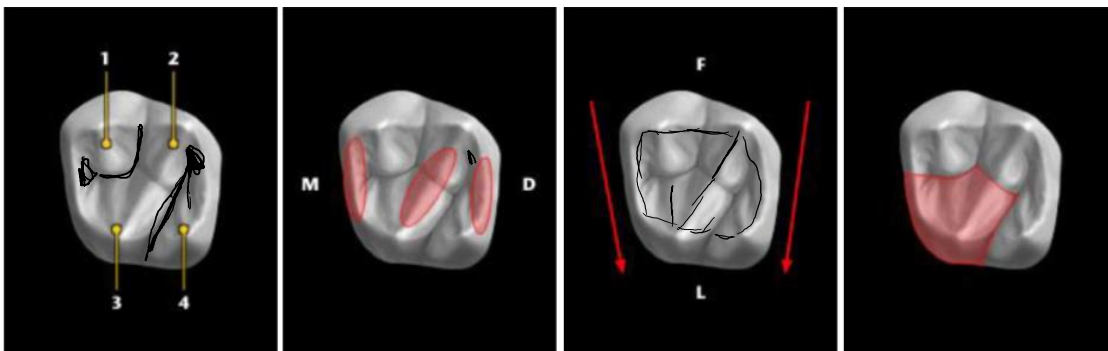
- Rhomboid occlusal outline
- Largest of all molars
- 5 cusps
 - o Largest = mesiolingual
 - o Smallest = Carabelli
- Facial groove divides 2 facial cusps, originates in central pit
- Mesiofacial cusp wider than distofacial cusp
- Mesiolingual cusp can be viewed from facial through V groove between distal and mesial ridges of facial cusps
- Mesiolingual ^{groove} ~~cusp~~ crosses mesiodistally to separate cusp of carabelli from mesiolingual cusp
- Oblique Ridge between distofacial cusp and mesiolingual cusp



Dental Morphology Review

Maxillary 2nd Molar

- Shorter crown
- Square shape from occlusal view
- Similar faciolingual length to 1st molar
- Narrower mesodistally
- 4 cusps (no cusp of carabelli)
 - o Largest = mesiolingual and mesiofacial
- Many supplemental grooves
- Less distinct facial groove
- 2 distal cusps shorter occlusal cervically
- Can see Mesial distal cusp through facial groove



Primary Dentition

- Numbering system changes! Quadrants are numbered **5, 6, 7, 8**, instead of 1, 2, 3, 4 respectively.
- Universal naming switches to (Upper Right) A, B, C, D, E – (Upper Left) F, G, H, I, J – (Lower Left) K, L, M, N, O, - (Lower Right) P, Q, R, S, T
- Only have 1 Central, 1 Lateral, 1 Canine, 2 Molars. Missing premolars

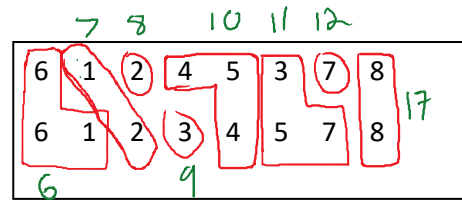
Primary Dentition Sequence (months)

Permanent Eruption Sequence (Tetris Method)

Dental Morphology Review

(Plus 4 Method)

Lower		Upper
6	Centrals	8
10	Laterals	12
14	1 st Molar	16
18	Canine	20
22	2 nd Molar	24



AGE	DECIDUOUS TEETH VISIBLE	
6-8 months	mandibular central incisors	
12 months	all incisors	
18 months	all incisors, first molars and canines	
30 months	all deciduous teeth	

AGE	PERMANENT TEETH VISIBLE	DECIDUOUS TEETH PRESENT
6 years	Mandibular first molars	All deciduous teeth
9 years	First molars and incisors	Canines and molars
10 years	First molars, incisors, & mandibular canines	None
11.5 years	First molars, incisors, canines, & premolars	None
12 years	First & second molars, incisors, canines, & premolars	None
18 years	All permanent teeth	none

Sequence of Eruption – Maxilla - 6,1,2,4,5,3,7,8
 Sequence of Eruption – Mandible - 6,1,2,3,4,5,7,8

- Tooth formation begins at 7 weeks in utero, mineralization at 4 months fetal
- Eruption pattern is symmetrical
- Mandibular always erupt first. Sequence is more important than timing

Permanent Premolar (1 and 2) erupt underneath the Primary Molar 1 and 2. Permanent 1st Molar erupt distally to Primary 2nd Molar.

Primary Vs Permanent

- Enamel and dentin are thinner
- Enamel is thin with consistent depth
 - o Primary enamel thickness: **Buccal 1/3 = 0.39-0.08mm, Incisal 1/3 = 0.15 – 0.05mm, Cervical 1/3 = 0.22-0.04mm**
- Smaller and whiter (enamel less mineralized, therefore is more opaque, and cant see dentin)

Dental Morphology Review

- Pulp horns extend high occlusally (increased chance of pulp exposure)
 - o Dentin thickness between pulp and enamel is thinner
 - o Pulp chambers large relative to crown
- Less mineralized
- Bulbous crowns, shorter root to crown ratio

Primary Anteriors

- No depressions on labial surface
- No mamelons
- Prominent labial ridge
- Cingulum (1/3rd of lingual surface)
- Proportionally long roots compared to crown
- Narrow mesiodistally
- Labial bend of the roots at apical 1/3

Maxillary Incisors

Centrals

- Larger mesiodistally than incisocervically (wider than tall)
- Convex facial surface (same with permanent)
- Lingual surface smoothly contoured
- Conical root
- 4 Lobes

Laterals

- Narrower than centrals
- Prominent lingual marginal ridges
- Deep lingual fossa
- Conical root
- Pulp chamber at CEJ

Maxillary Canine

- Mesial cuspal ridge longer than distal cuspal ridge (opposite to the permanents)
- 2 fossae, 3 lingual ridges
- Longer root than incisor
- Tapered root

Mandibular Incisors

Centrals

- Disto-mesio incisal line angle 90 degrees
- Incisal edge aligned with longitudinal axis of tooth

Laterals

- Longer inciso-cervical length
- Wider mesiodistally
- Rounded distoincisor line angle
- Larger lingual marginal ridges
- Deeper lingual fossa
- Longer root

Mandibular Canine

- Distal cuspal ridge longer than mesial (normal)
- Narrower mesiodistally
- Less prominent lingual features
- More taper in root

Dental Morphology Review

Primary Posteriors

- Wider crowns mesiodistally, shorter cervico-occlusally
- 2nd molars larger than 1st molars (backwards to permanent)
- Narrow occlusal surface buccolingually
- Shallow occlusal anatomy
- Rounded buccal cusps, not pointed
- Few grooves or depressions in crowns
- Prominent cervical ridge
- Enamel rods at cervix slope occlusally (permanent teeth slope cervically)
- Root furcation closer to crown
- Wide root spread of thinner roots
- 2nd molar root spread more than 1st molar

Maxillary 1st Molars

- Triangular occlusal outline
- 3, or 4 cusps
- Oblique ridge
- Larger mesiofacial ridge
- Prominent faciocervical ridge
- 3 roots

Maxillary 2nd Molars

- Resembles 1st primary molar
- Rhomboid occlusal outline (greater faciolingual width)
- May have cusp of Carabelli
- Mesiolingual is widest and tallest cusp
- 3 roots
- Mesiofacial pulp horn is largest

Mandibular 1st Molar

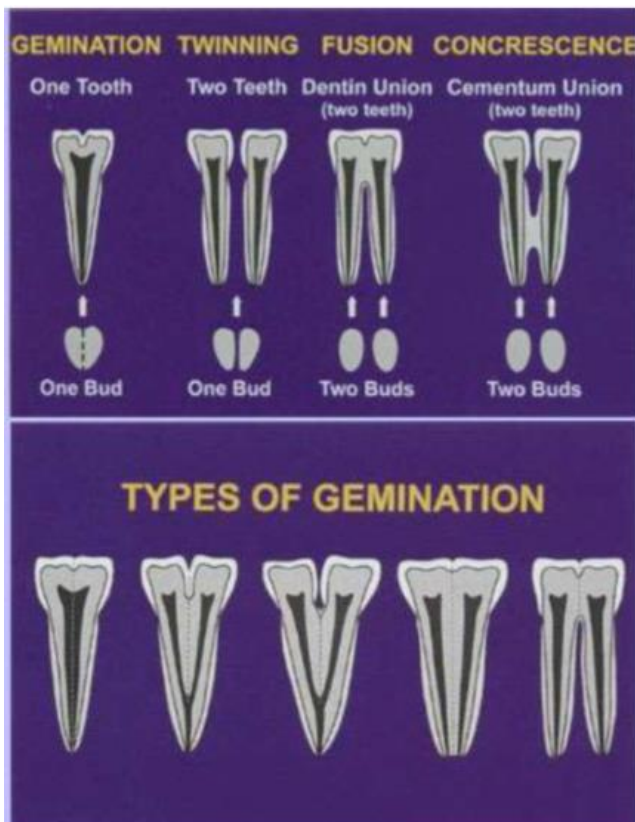
- Extreme occlusal convergence
- Narrow occlusal table
- Faciocervical ridge at mesial aspect
- Wider mesiofacial cusp
- **Highest cusp is distofacial**
- 4 cusps, 2 roots, 3 canals
- Transverse ridge at mesial

Mandibular 2nd Molar

- Resembles 1st
- 5 cusps, 2 roots, 3 or 4 canals

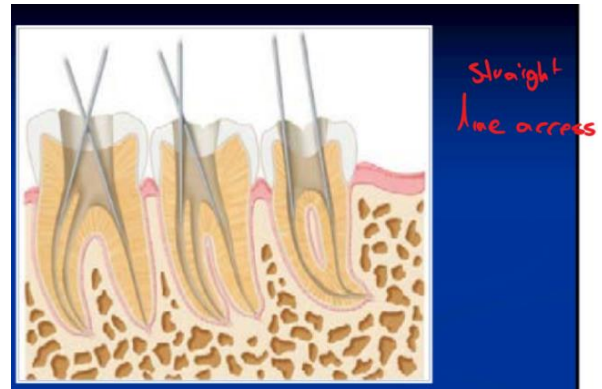
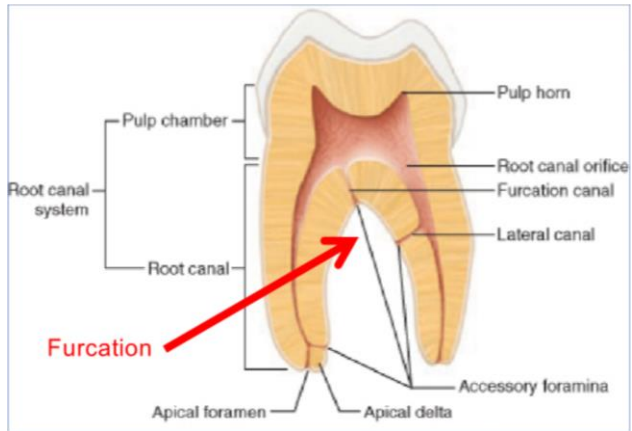
Anomalies

- Ankylosis (Very short roots)
- Gemination
 - o Attempted division of single tooth germ, resulting in one structure with complete or incompletely separated crowns with a single root and root canal
- Twinning
 - o Production of 2 teeth from a single tooth germ. Separate roots and canals
- Fusion
 - o Union of 2 normally separate teeth (central incisor and later incisor for example)
 - o May be the result of pressure and crowding during tooth development



- Enamel Hypoplasia
 - o Equality of enamel effected
 - o Can be limited to one tooth or many
 - o Causes tooth sensitivity, increased risk of caries
 - o Appears white, yellow or brownish. Rough pitted surface
 - o Environmental and genetic factors
 - Trauma of teeth in premature infants, infection, poor nutrition pre-and post natally

Roots



- Endodontic Access uncovers root canal systems to treat affected pulpal tissues
 - o Important to conserve tooth structure, and create straight line access towards the Apical root third (can turn a corner once in the canal).

How to discovery root anatomy:

- Radiographic
- Periapical films
- Cone Beam Computed Tomography (CBCT): 3D radiography
- Clinical clues
- Visualization

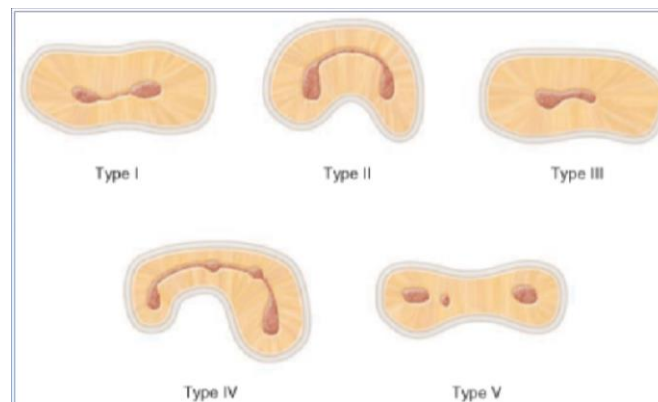
Furcation Canals

- Small accessory canal off shoots from main root canal. Extends into root furcation space

Isthmus Classification

- Fusion of canals

Type 1	Incomplete isthmus, faint communication btwn 2 canals
Type 2	2 Canals with definite connection
Type 3	Very short (close together) connection
Type 4	Complete or incomplete connection between 3+ canals
Type 5	2 or 3 canals without visible connection



Apical Root

- At apical tip, the root constricts (Apical constriction/minor apical diameter).
 - o Narrowest part of the canal
- After the Apical constriction, the canal widens to exit root at apical foramen
- Apical foramen dictates width of file to be used. Don't want file to be small enough to fit through.

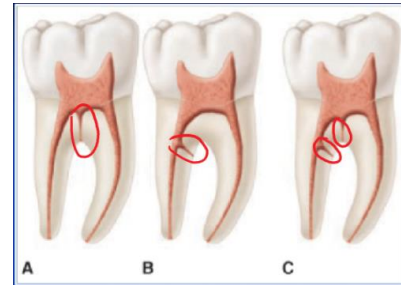


Dental Morphology Review

Mandibular 1st Molars

3 patterns of furcation canals:

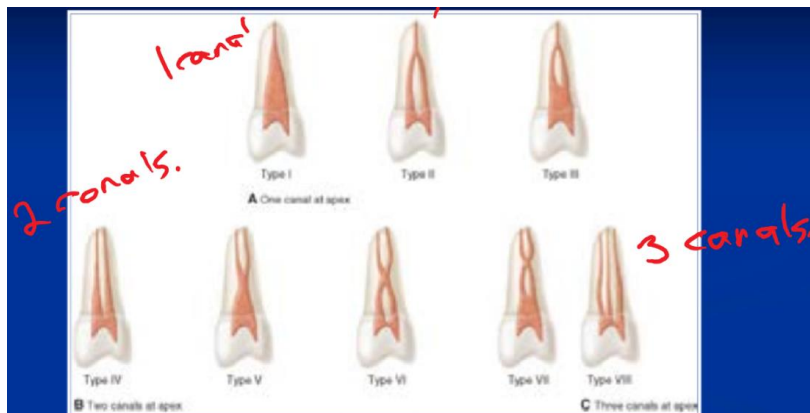
1. Single furcation from pulp chamber to intraradicular region **(13% of cases)**
2. Lateral canal extends from coronal third of major canal into furcation region **(23% of cases, and 80% of these occur in distal root canal)**
3. Both lateral and furcation canals **(10% of cases)**



Mandibular Premolar Roots

8 Pulp space configurations:

1 Root Canal		2 Root Canals		3 Root Canals	
Type 1	Single Canal	Type 4	2 Canals	Type 8	3 Canals
Type 2	Cervical split, joins at apex	Type 5	Split in middle third		
Type 3	Middle third split, joins at apex	Type 6	Split in cervical third, crossover in middle third		
		Type 7	Split in Middle third, crossover in apical third		

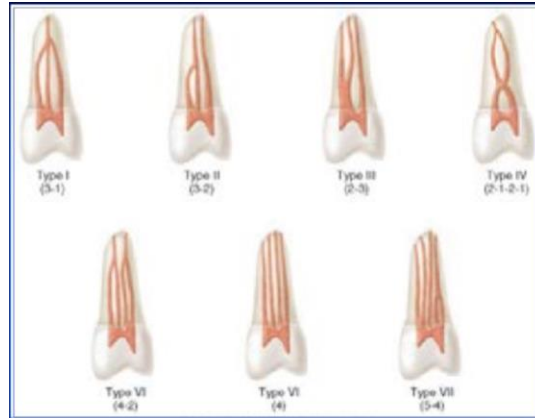


Dental Morphology Review

Mandibular Anteriors:



Mandibular Molars

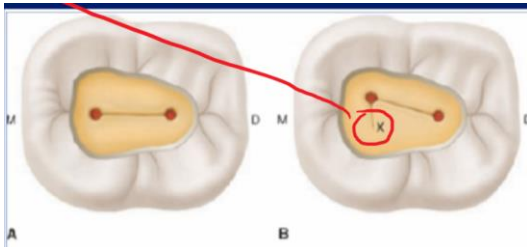


Typically only have 1 canal

Mandibulars, 30% chance of 2 canals

Canal Symmetry

- Canals trend to following symmetry
- If 2 canals are in 1 plane there is likely not another. However, if they are not in same plane there is likely another canal to create triangular symmetry



Dental Morphology Review

Maxilla							
Central Incisors	Lateral Incisor	Canine	1 st Premolar	2 nd Premolar	1 st Molar	2 nd Molar	3 rd Molar
1 canal: 100%	1 canal: 100%	1 canal: 100%	1 canal: 8% 2 canals: 87% 3 canals: 5%	1 canal: 48% 2 canals: 51% 3 canals: 1%	<u>Palatal Root</u> 1 canal: 100% <u>DB Root</u> 1 canal: 100% <u>MB Roots:</u> 1 canal: 15% 2 canals: 84% 3 canals: 1%	<u>Palatal Root</u> 1 canal: 100% <u>DB Root</u> 1 canal: 100% <u>MB Root</u> 1 canal: 30% 2 canals: 69% 3 canals: 1%	1 canal: 3% 2 canals: 4% 3 canals: 58% 4 canals: 28% 5+ canals: 7%
Mandible							
Central Incisors	Lateral Incisor	Canine	1 st Premolar	2 nd Premolar	1 st Molar	2 nd Molar	3 rd Molar
1 canal: 70% 2 canals: 30%	1 canal: 75% 2 canals: 25%	1 canal: 78% 2 canals: 22%	1 canal: 70% 2 canals: 29.5% 3 canals: 0.5%	1 canal: 97.5% 2 canals: 2.5% 3 canals: rare	<u>Mesial Root</u> 1 canal: 12% 2 canals: 87% 3 canals: 1% <u>Buccal Root</u> 1 canal: 70% 2 canals: 30%	<u>Mesial Root</u> 1 canal: 27% 2 canals: 73% <u>Buccal Root</u> 1 canal: 92% 2 canals: 8%	<u>Mesial Root</u> 1 canal: 84% 2 canals: 16% <u>Distal Roots</u> 1 canal: 96% 2 canals: 4%

MISC

- C Shaped Roots: Fusion of apical tips on 2 roots making a "loop"
- Root canal appearing to disappear in periapical radiograph is indicative that root is splitting.