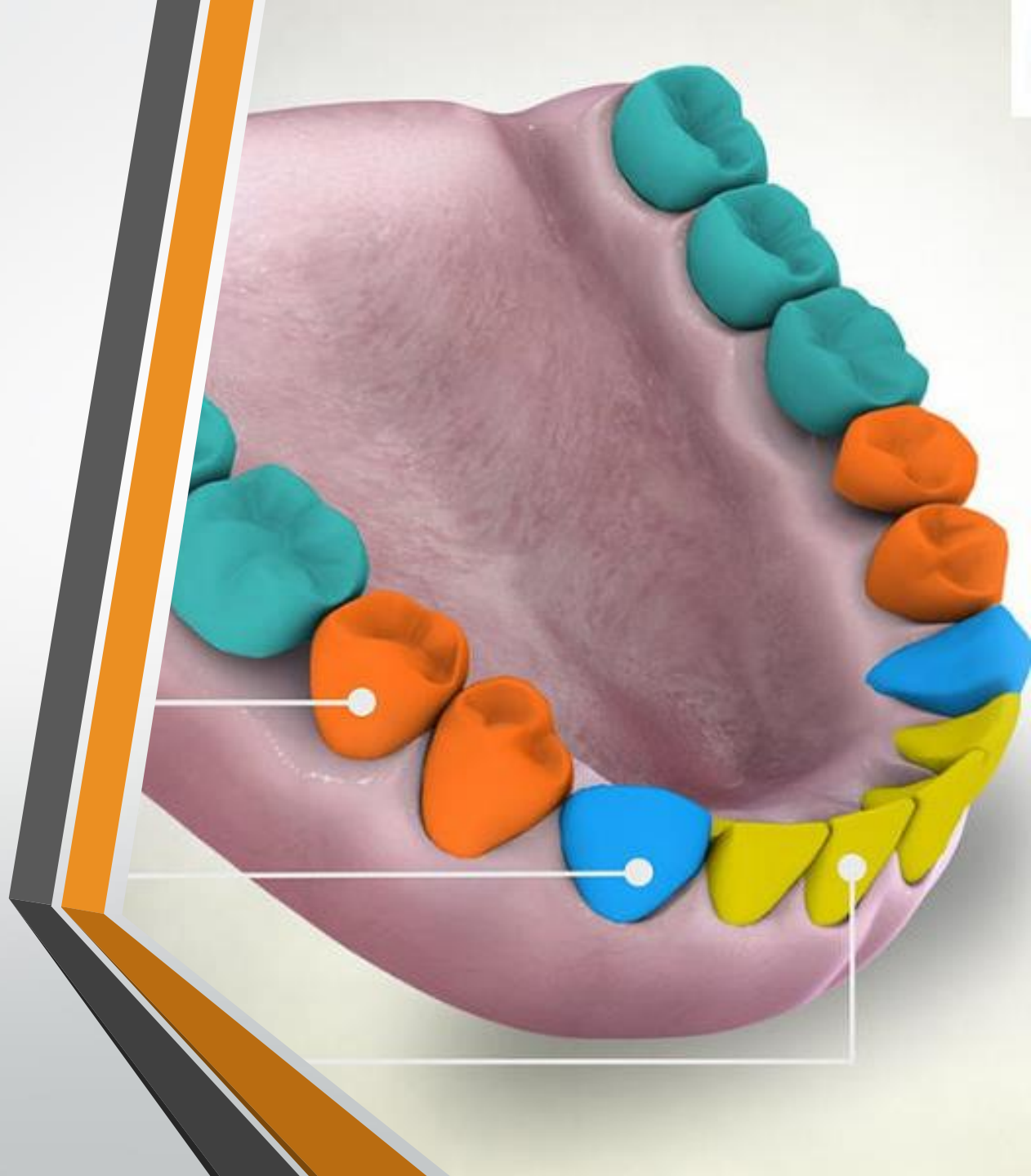
Maxillary Premolars

By: Dr. Lina Helmy

Premolars

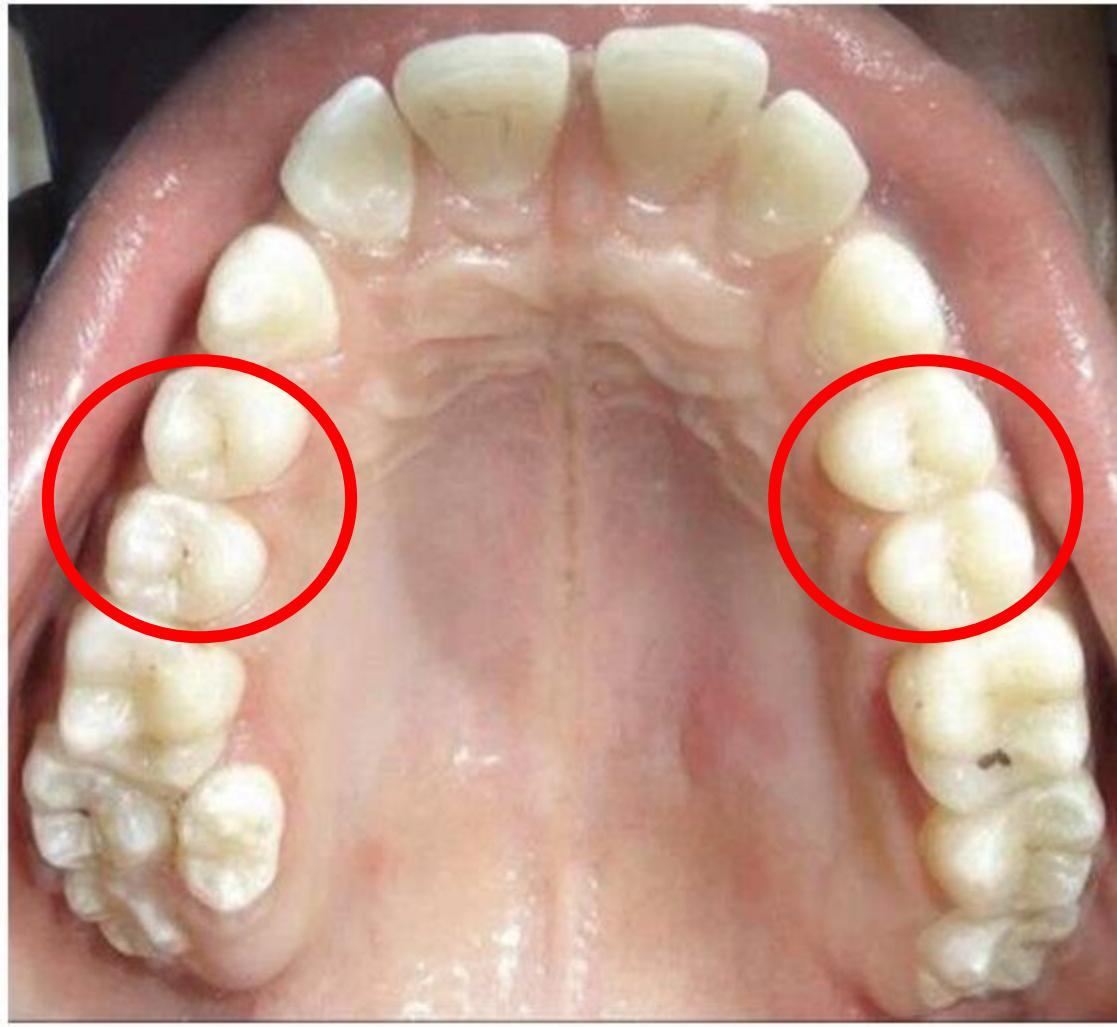
General characteristics:

- Situated **mesial** to the permanent molars
- They **replace the deciduous molars**
- There are **two premolars** in each quadrant.
- They have usually two cusps------ bicuspid. This term is misleading????

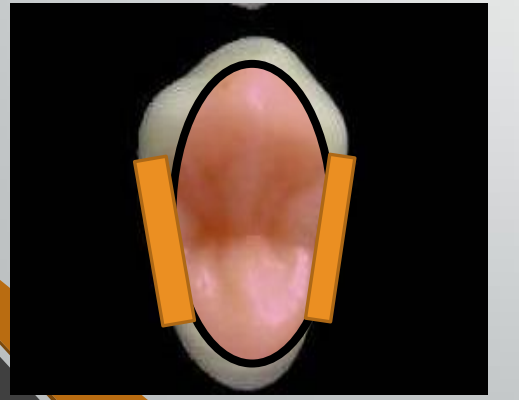


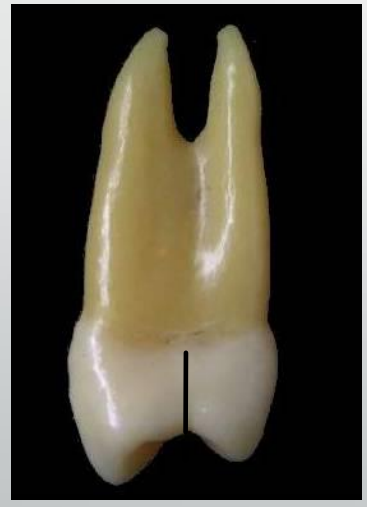
They are developed from four lobes Except???? (Lower second premolar (3 cusps type)

- The cusps of upper and lower first premolars are ***sharper*** *than those of* the second premolars.



Premolars	Anterior Teeth (Incisors &canine)
Occlusal surfaces with well-developed cusps	Incisal edges (Except canine has cusp slopes)
Marginal ridges on occlusal surface	Marginal ridges on lingual surface
Crown length shorter occluso-cervically	Crown length longer occluso-cervically
Contact areas broad and are more cervically	Contact areas narrow and are more incisally
Cervical line is less curved proximally	Cervical line is more curved proximally





Incisal

Facial

Lingual

Distal

Maxillary first premolar

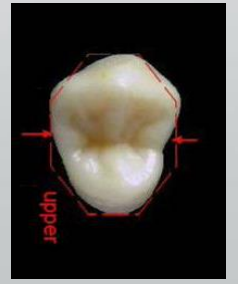
It has 5 surfaces:

Buccal

Lingual

Mesial

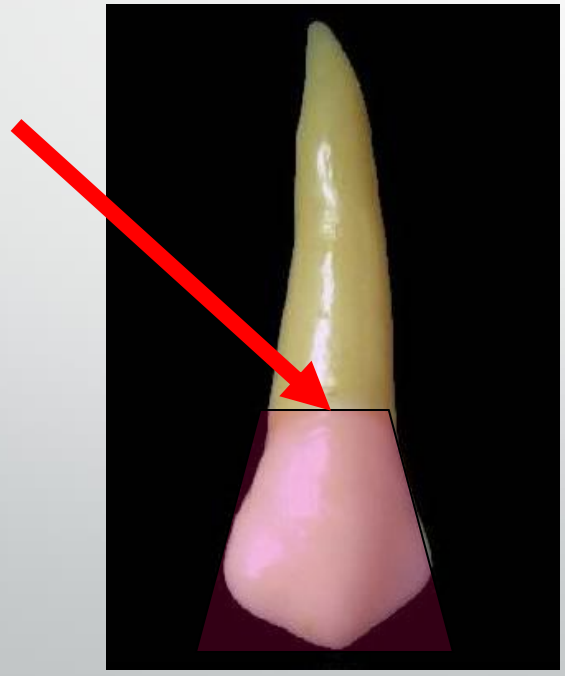
Distal

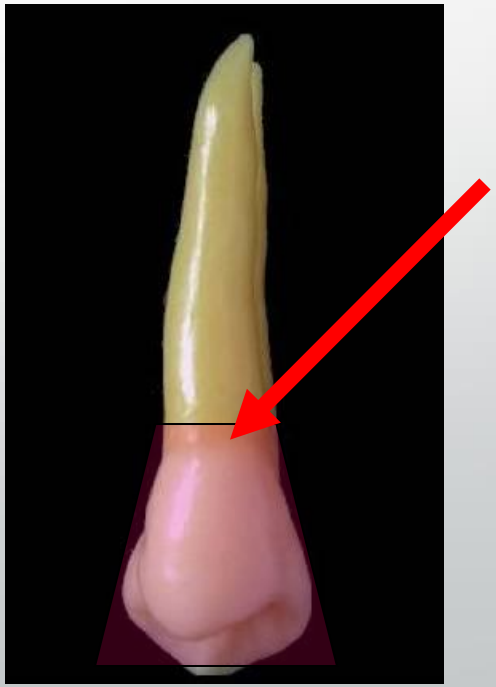


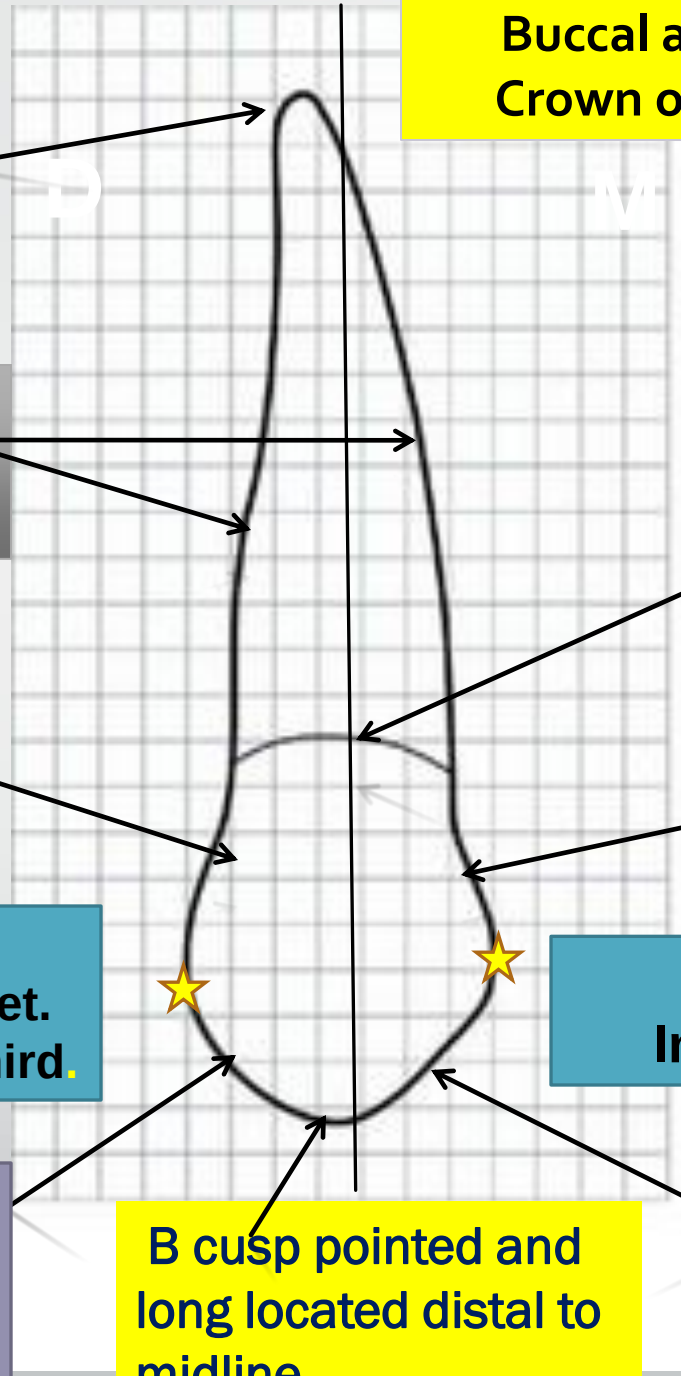
occlusal

Geometric outline of the crown buccal and lingual

trapezoid outline , the smallest uneven side cervically.







Buccal aspect
Crown outline

pointed apex that is slightly curved distally

Root outline

Conical. The M and D outline of the root tapers to a apex

Cervical L.: convex root wise.

DOL: nearly concave.

MOL: nearly concave.

DCA: In the junction bet. Middle and occ third.

MCA: In the middle.

DCS: Shorter and nearly concave.

B cusp pointed and long located distal to midline

MCS: Longer and nearly concave.

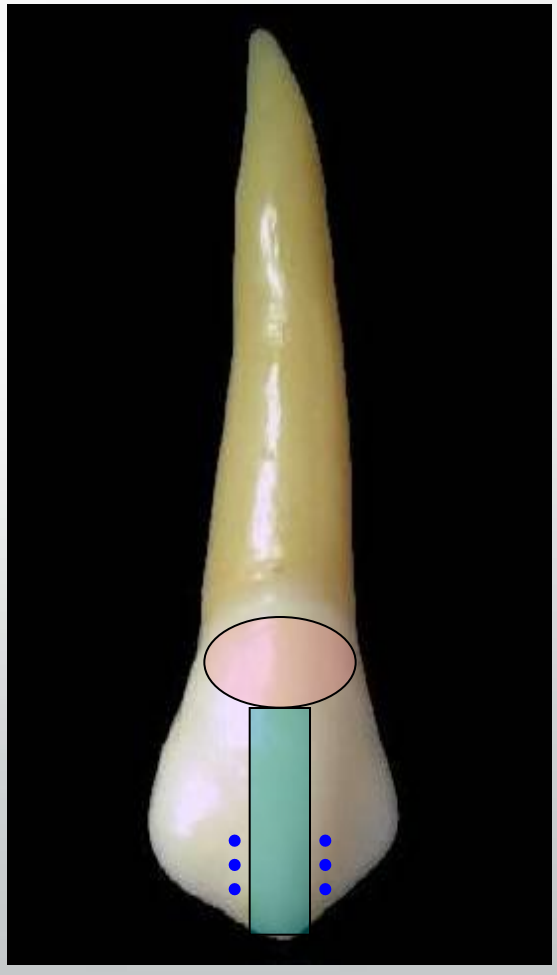
Surface anatomy of the crown buccally

Elevations:

- Cervical ridge
- Buccal ridge

Depressions:

2 Shallow depressions are present mesial and distal to the B ridge (M&D developmental grooves)



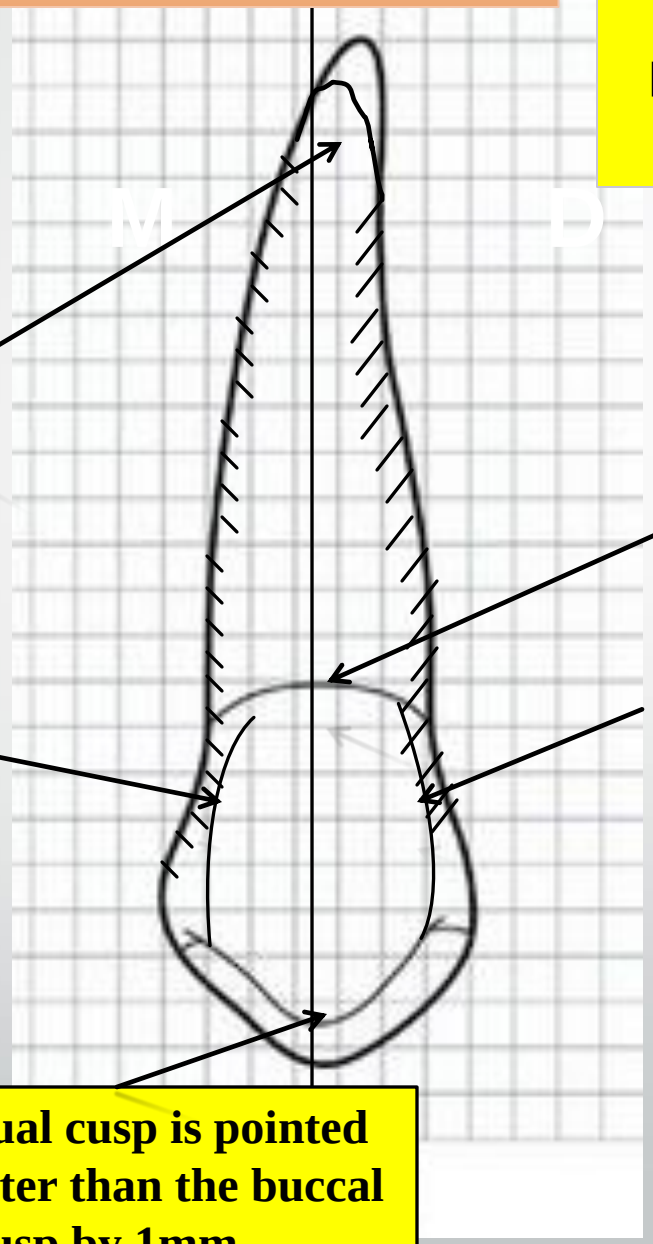
Lingual aspect

Root outline

80% of upper 4 is double rooted (buccal and lingual) 20% single rooted.

If two roots, the lingual root equal or shorter and narrower than the buccal root curved distally.

lingual
Crown outline
Narrower due to lingual convergence



c.L.: convex root wise.

DOL: convex.

MOL: convex.

the lingual cusp is pointed and shorter than the buccal cusp by 1mm

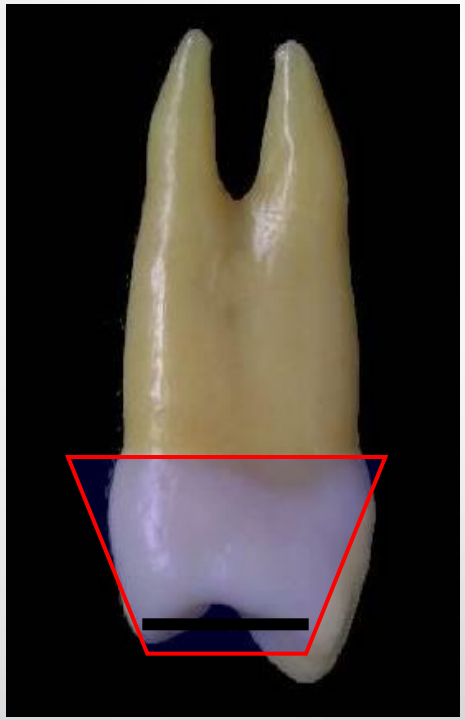
Lingual Surface anatomy

The surface of the crown is convex similar to lingual ridge

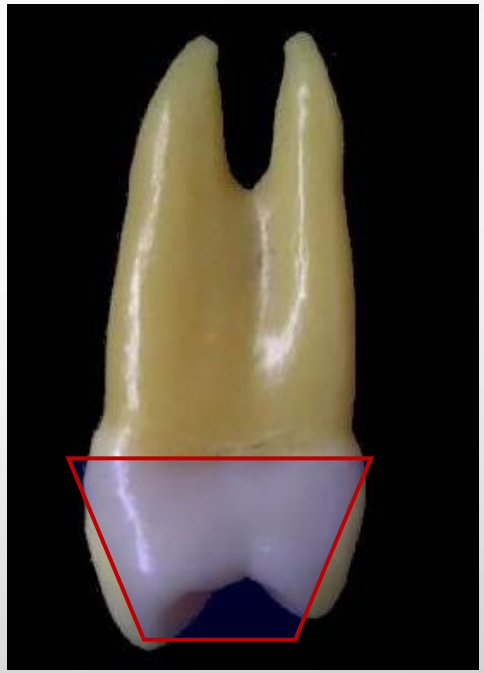
Geometric outline of the proximal aspect

Trapezoid in shape

Distal surface



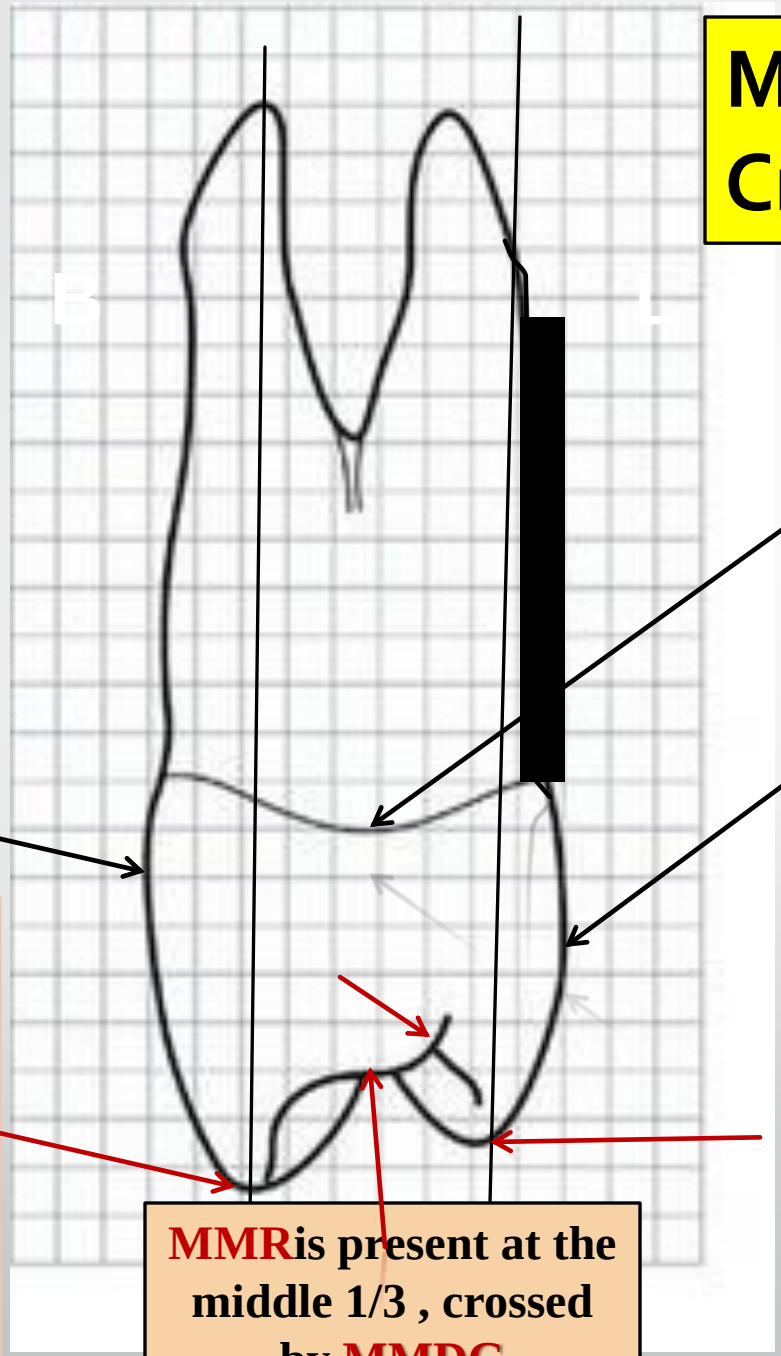
Mesial surface



Smallest of the uneven sides

is occlusaly

Mesial aspect Crown outline



Cervical line curves occlusally

B.O.L. is convex with the maximum convexity at the cervical 1/3

L.O.L. is convex with the maximum convexity at the middle 1/3

- **B** cusp is longer than **L** cusp by 1mm.
- B cusp in a line with apex of B root.

- L cusp in a line with lingual border of L root.

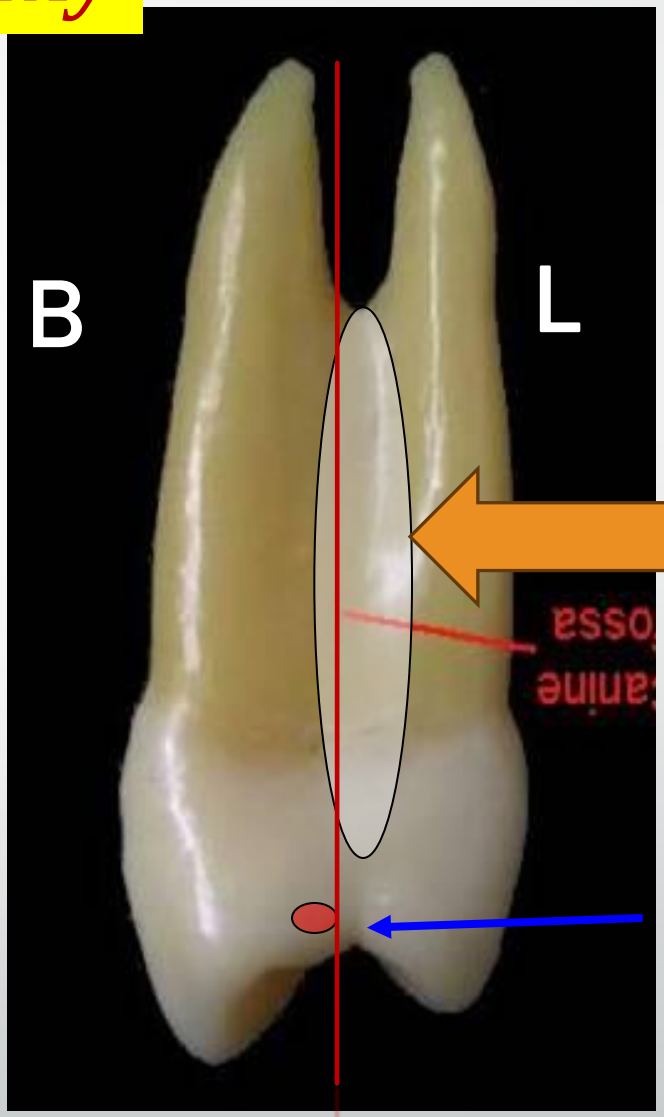
MMR is present at the middle 1/3 , crossed by MMDG

Mesial surface anatomy

Mesial contact area: At the middle third and slightly buccal to the midline

Mesial marginal developmental groove is crossing MMR and located lingual to the contact area.

Mesial Developmental depression in the crown and continues to the roots (canine fossa).



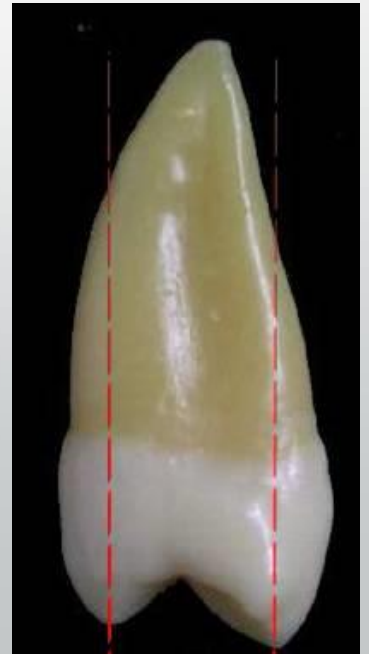
canine fossa

The roots

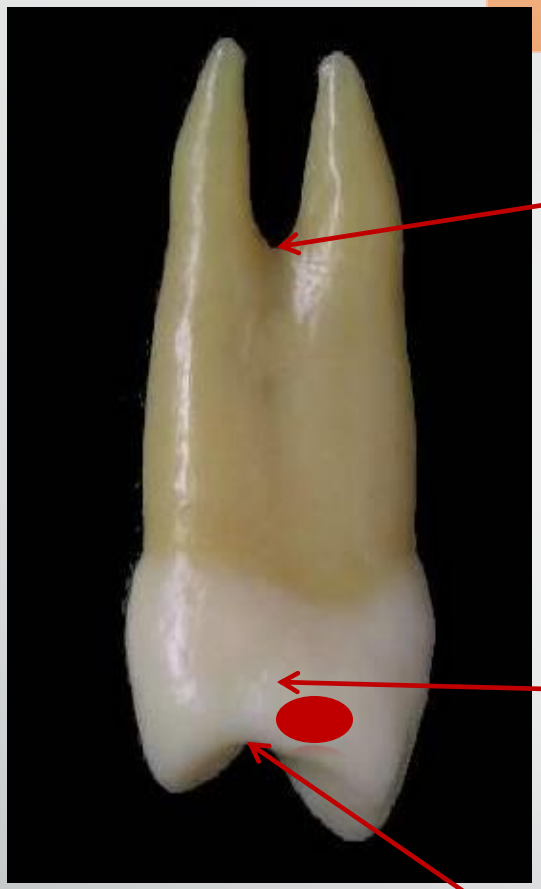
May be one or two roots but the majority is the bifurcated root *at the middle third .*

There is deep developmental depression along the root trunk.

* If ***one root is present*, *the root outlines end in a blunt*** apex above the center of the crown.



Distal aspect Is similar to the mesial one except:

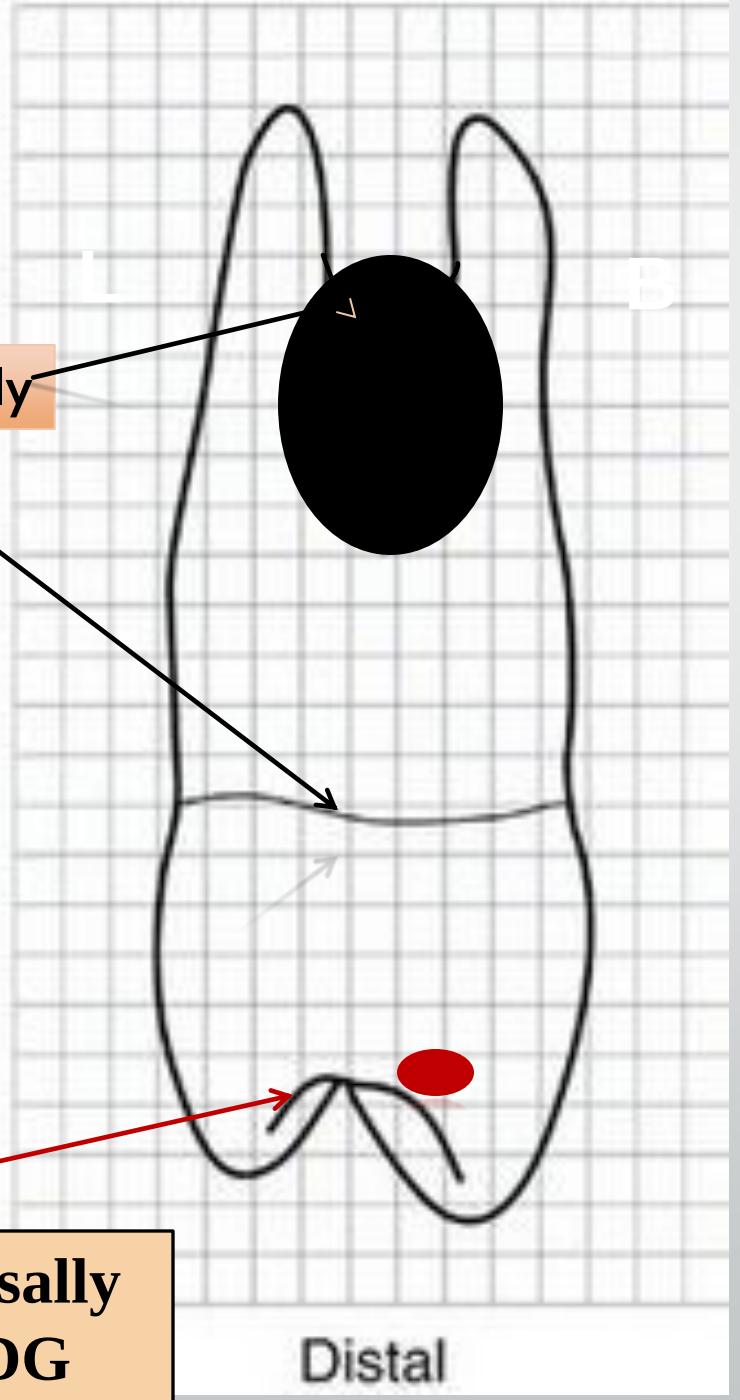


5- Bifurcation more apically

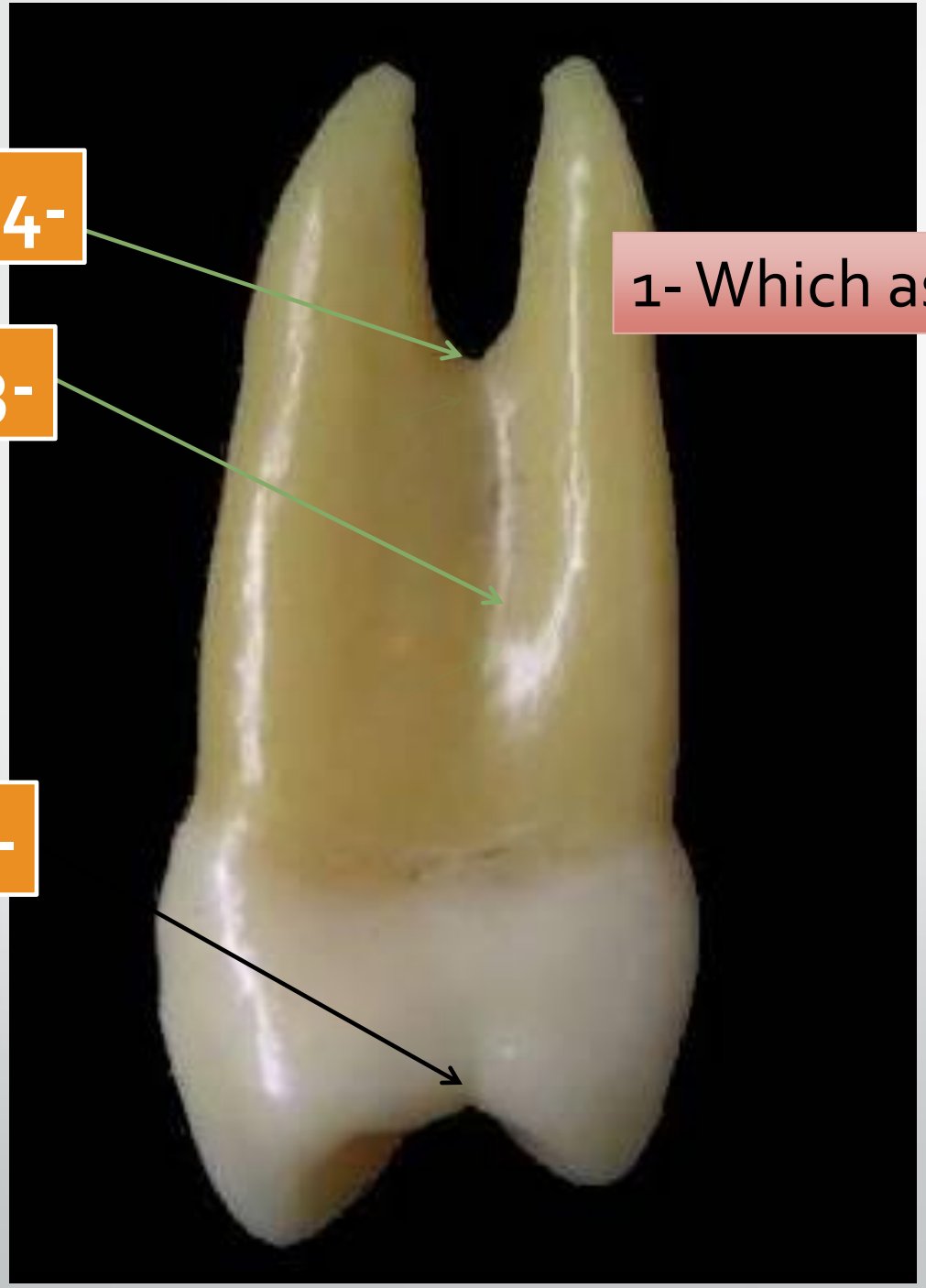
4- Cervical line less curved

3- The contact area is broader and is located more *occlusally*

2- No developmental depression on the crown or root



1- DMR is more occlusally and not crossed by DG


4-
3-
2-
1- Which aspect

Maxillary second premolar

It has 5 surfaces:

Buccal

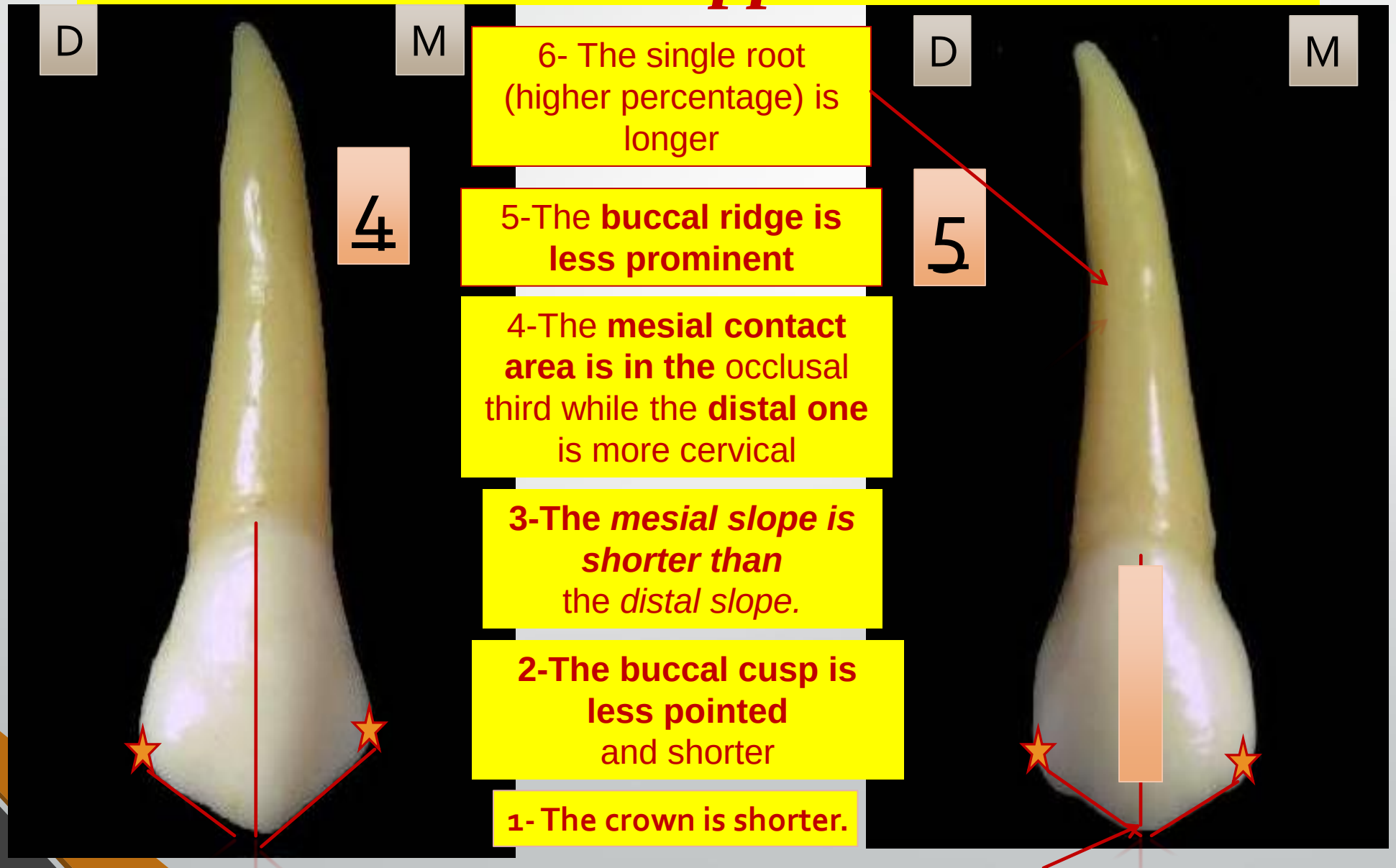
Lingual

Mesial

Distal

occlusal

Buccal aspect
Similar to upper 4 but:



6- The single root (higher percentage) is longer

5-The **buccal ridge is less prominent**

4-The **mesial contact area is in the** occlusal third while the **distal one** is more cervical

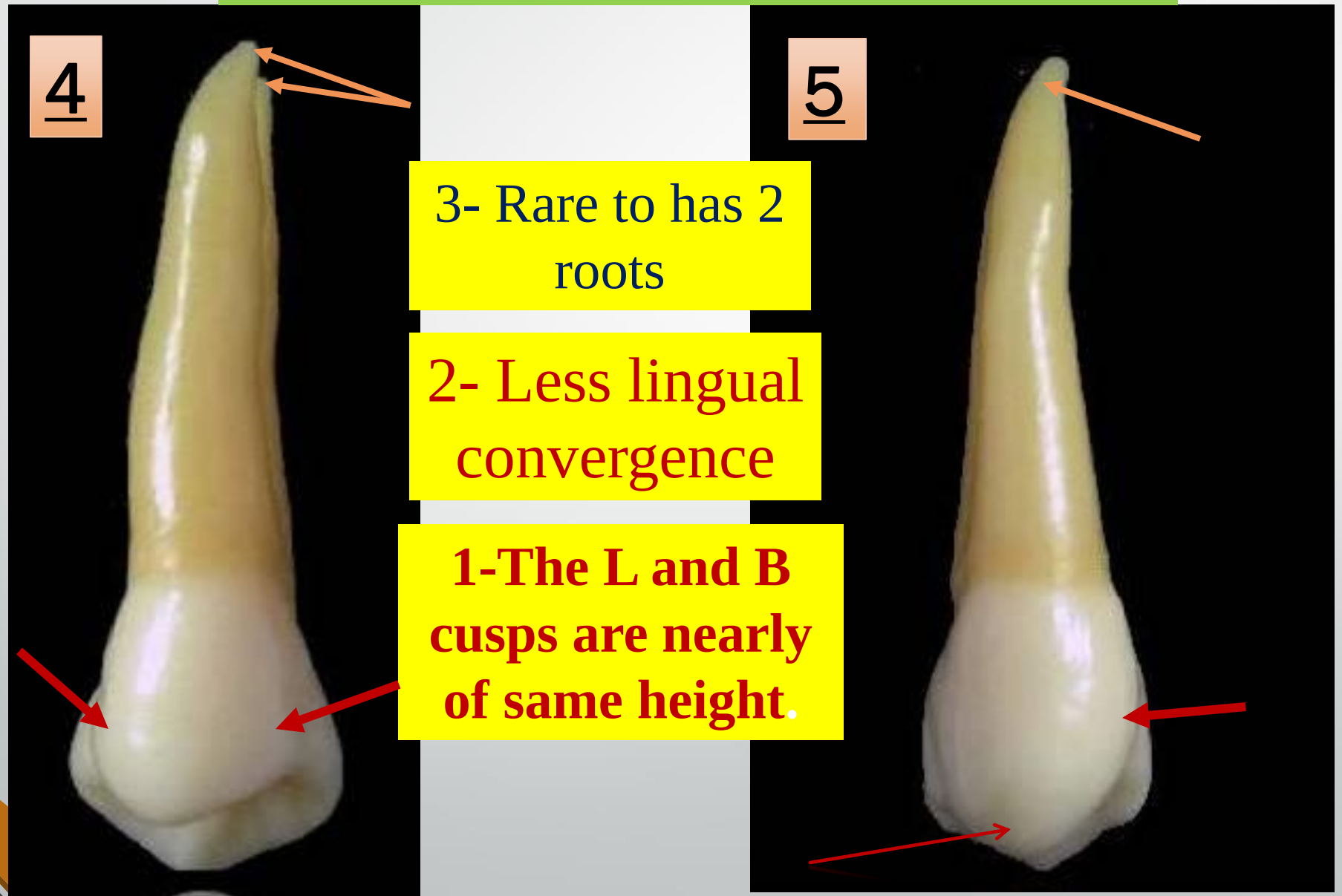
3-The *mesial slope is shorter than* the *distal slope.*

2-The buccal cusp is less pointed and shorter

1- The crown is shorter.

Lingual aspect

In comparison to maxillary first premolar



3- Rare to has 2 roots

2- Less lingual convergence

1-The L and B cusps are nearly of same height.

In comparison to maxillary first premolar

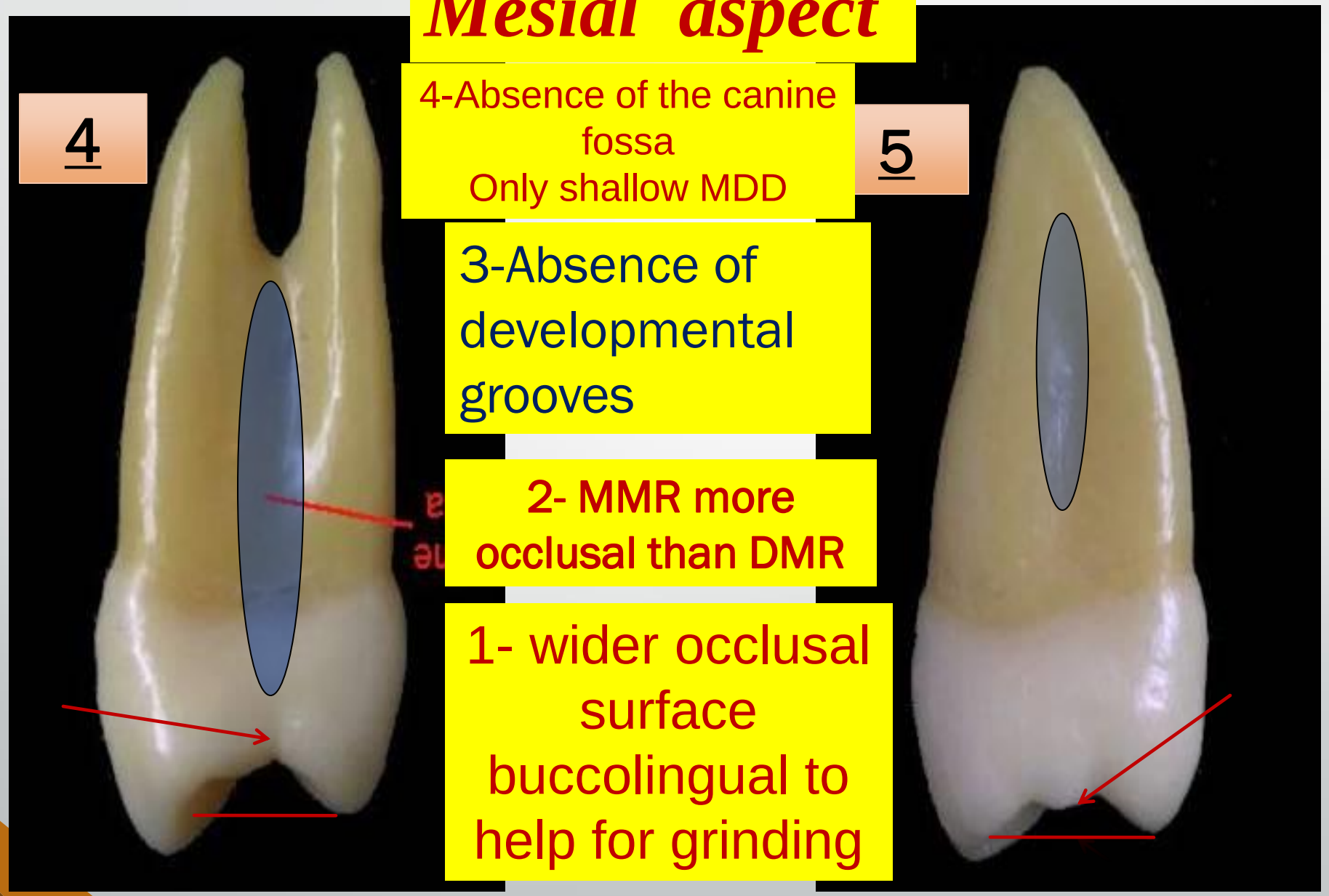
Mesial aspect

4-Absence of the canine fossa
Only shallow MDD

3-Absence of developmental grooves

2- MMR more occlusal than DMR

1- wider occlusal surface buccolingual to help for grinding



Distal aspect

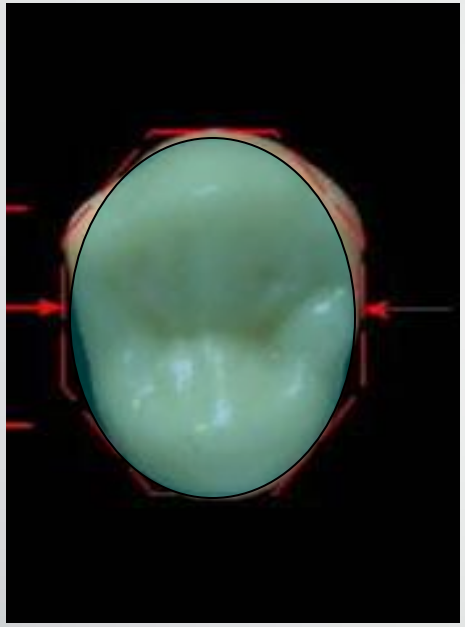
•One root

• if 2 roots the bifurcation will be more apically.

•Surface is smooth and convex except deeper DDD in the middle of the root than mesially.

Geometric outline of the occlusal aspect

In 5

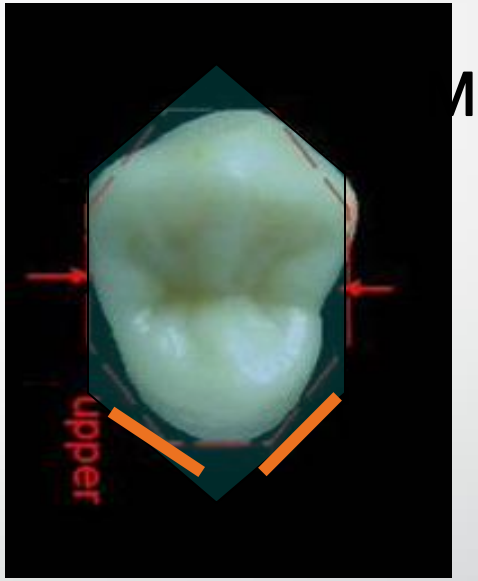


It is oval in shape

In 4

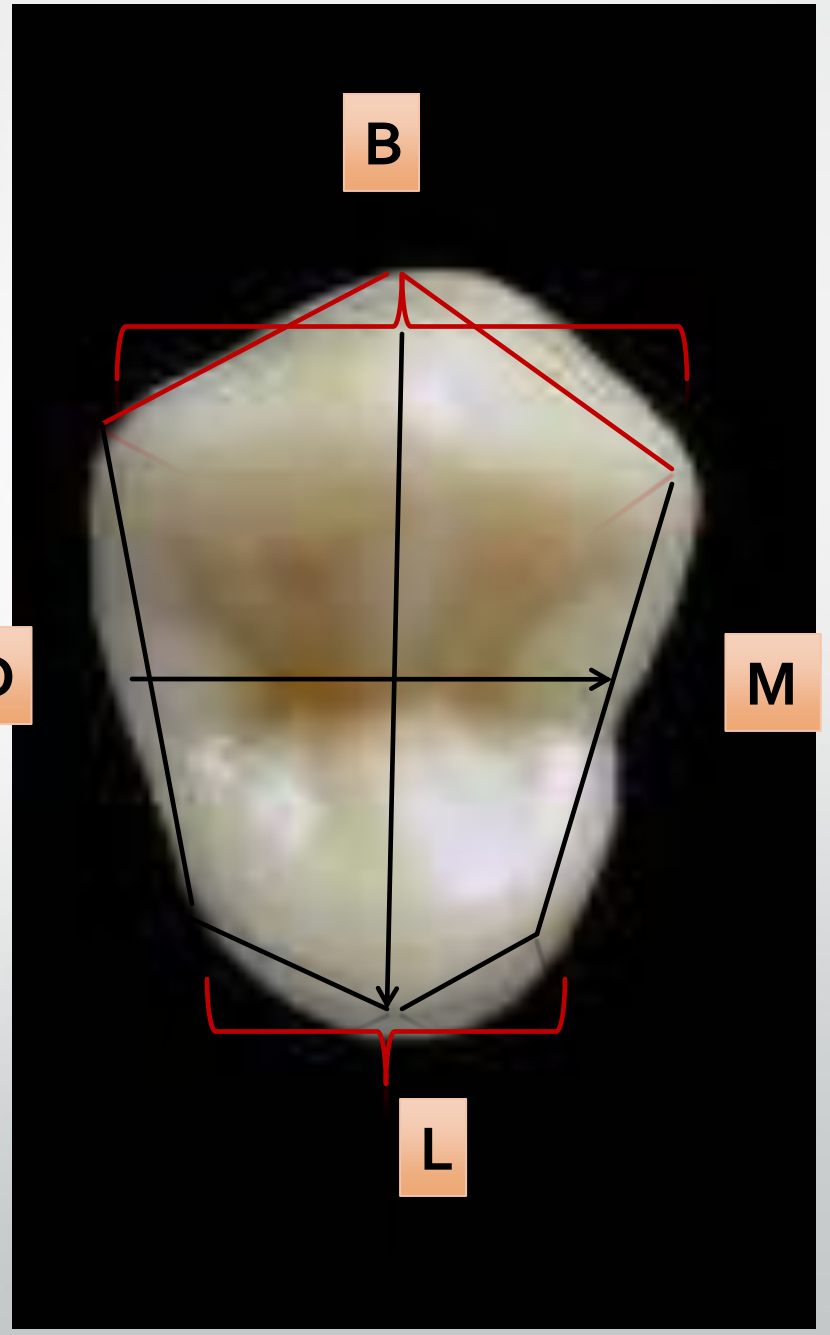
D

M



It is hexagonal in shape

- The crown ***converges lingually***
  - * The crown thickness is wider than its width.
  - * **The mesiobuccal & distobuccal sides are nearly equal in length.**
  - * The **mesial side is shorter than the distal one.**
  - * **The mesiolingual side is shorter than the distolingual one**



Elevations:

B triangular ridge.

L triangular ridge.

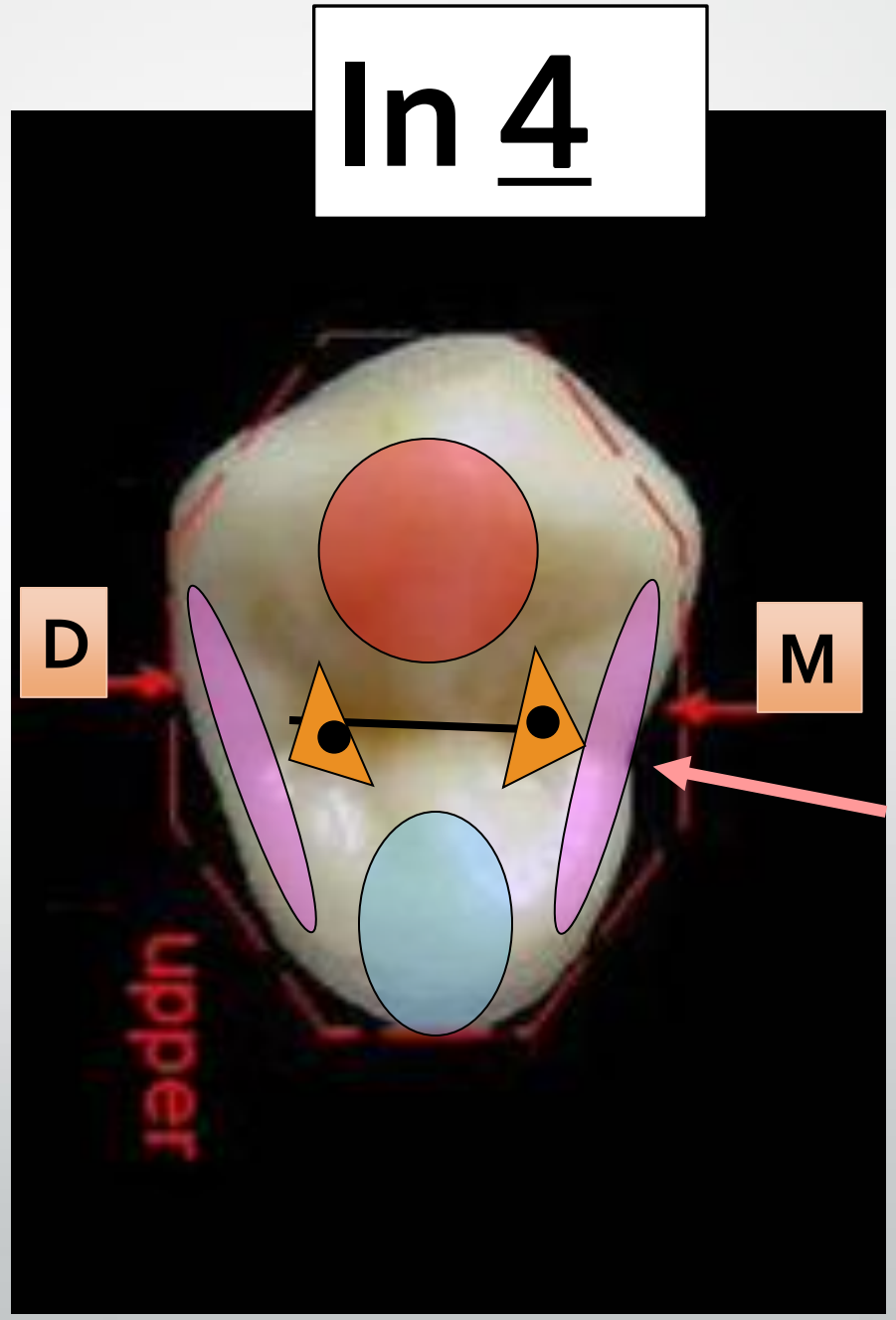
M & D marginal ridges

Depressions:

Central developmental groove

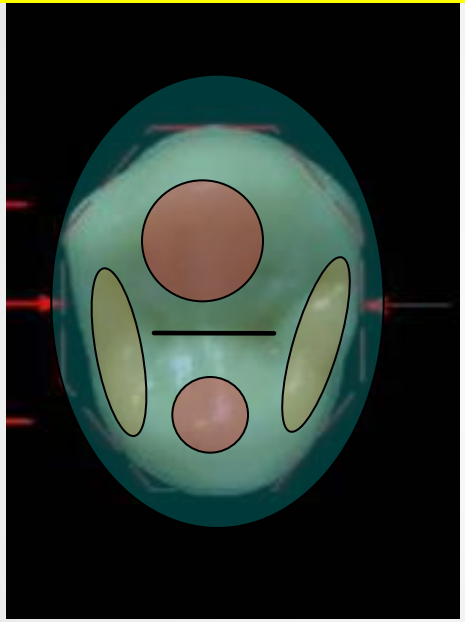
M and D triangular fossae with M and D pits.

M marginal developmental groove.



Occlusal aspect

D



M

In 5

It's oval

B triangular ridge.

L triangular ridge.

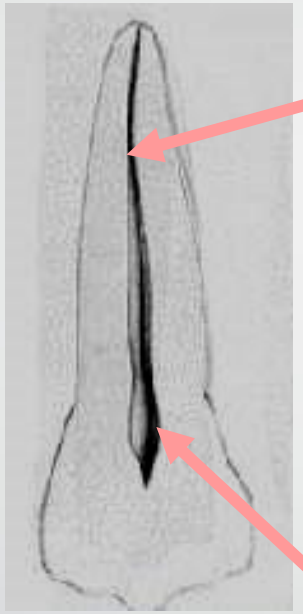
Thicker M & D MRs

Multiple supplemental grooves

Short central DG

Pulp cavity.

MD section



BL section

Root canals:

2 root canals (B&L)

L canal is larger &more accessible

Narrow

Wider

Pulp chamber:

Feature	Maxillary First Premolar	Maxillary Second Premolar
Number of Cusps	Two cusps (buccal and lingual)	Two cusps (buccal and lingual)
Cusp Heights	Buccal cusp is longer than lingual cusp	Buccal and lingual cusps nearly equal in height
Occlusal Outline Shape	Hexagonal	Oval
Number of Roots	Mostly two roots (buccal and lingual)	Usually single root
Root Morphology	Usually bifurcated with deep developmental groove on mesial surface	Single root with shallow longitudinal depressions
Number of Canals	Usually two canals	Usually one canal (sometimes two)
Central Groove	Long central groove with mesial marginal groove	Shorter central groove with more supplementary grooves
Marginal Ridges	Mesial marginal ridge often has a groove	No mesial marginal groove
Buccal Ridge	Prominent buccal ridge	Less prominent buccal ridge
Proximal Contact Areas	Middle third of the crown	Middle third of the crown
Developmental Grooves	Mesial developmental groove extends from central groove onto mesial surface	Supplementary grooves give wrinkled appearance

Key Differences Summary

- **Roots**: The upper first premolar usually has **two roots (bifurcated)**, while the upper second premolar **usually has one root**.
- **Cusp Size**: The **buccal cusp is significantly larger** than the lingual cusp in the first upper premolar, whereas the cusps are **more equal in size** in the upper second premolar.
- **Crown Shape**: The first upper premolar has a **more angular** crown, while the second upper premolar is **more rounded**.
- **Cusp slopes:** The first upper premolar is the only permanent tooth that has the **mesial slope longer** than the distal slope.
- **Function**: The first premolar is **more adapted for tearing**, while the second premolar is **better suited for grinding**.

Clinical Difficulties in Maxillary Premolars

- .Difficulty in Space Management: Maxillary premolars are **often extracted** for orthodontic treatment.
- Surgical Consideration:

1. Bifurcated Roots: Maxillary first premolars often have two roots, complicating extractions.
2. Proximity to Maxillary Sinus: Risk of sinus perforation during extraction.
3. Root Fracture Risk: Thin and fragile roots may fracture during surgical removal(Maxillary first premolar is called King of fracture).

- Endodontic Challenges:

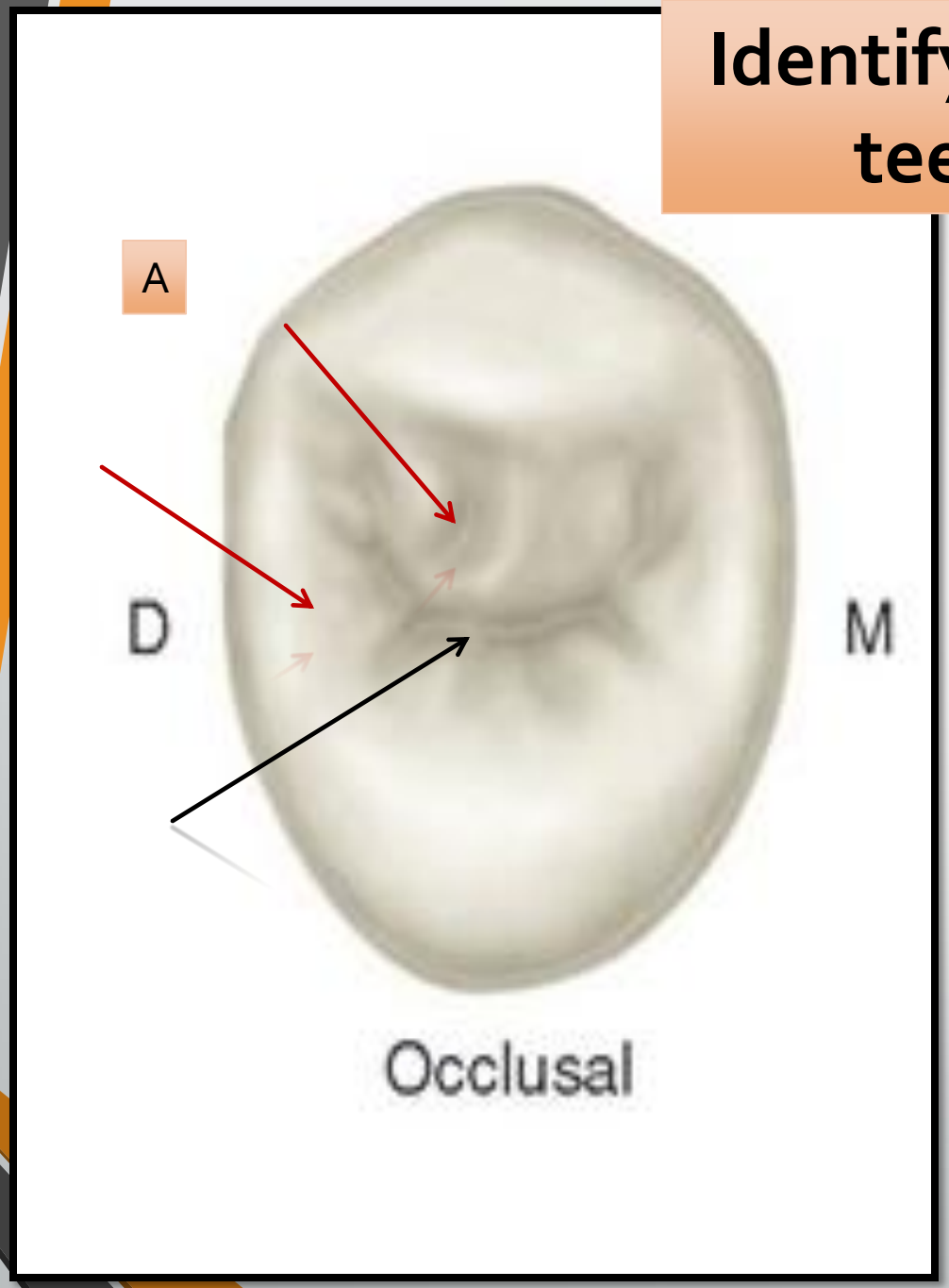
1. **Complex Root Canal Anatomy**: First premolars often have two canals, making treatment difficult.
2. **Narrow and Curved Canals**: Increases difficulty in instrumentation and obturation.
3. **Risk of Missed Canals**: Presence of an additional canal may be overlooked.
4. **Periapical Lesions**: Infection due to difficulty in achieving complete disinfection.

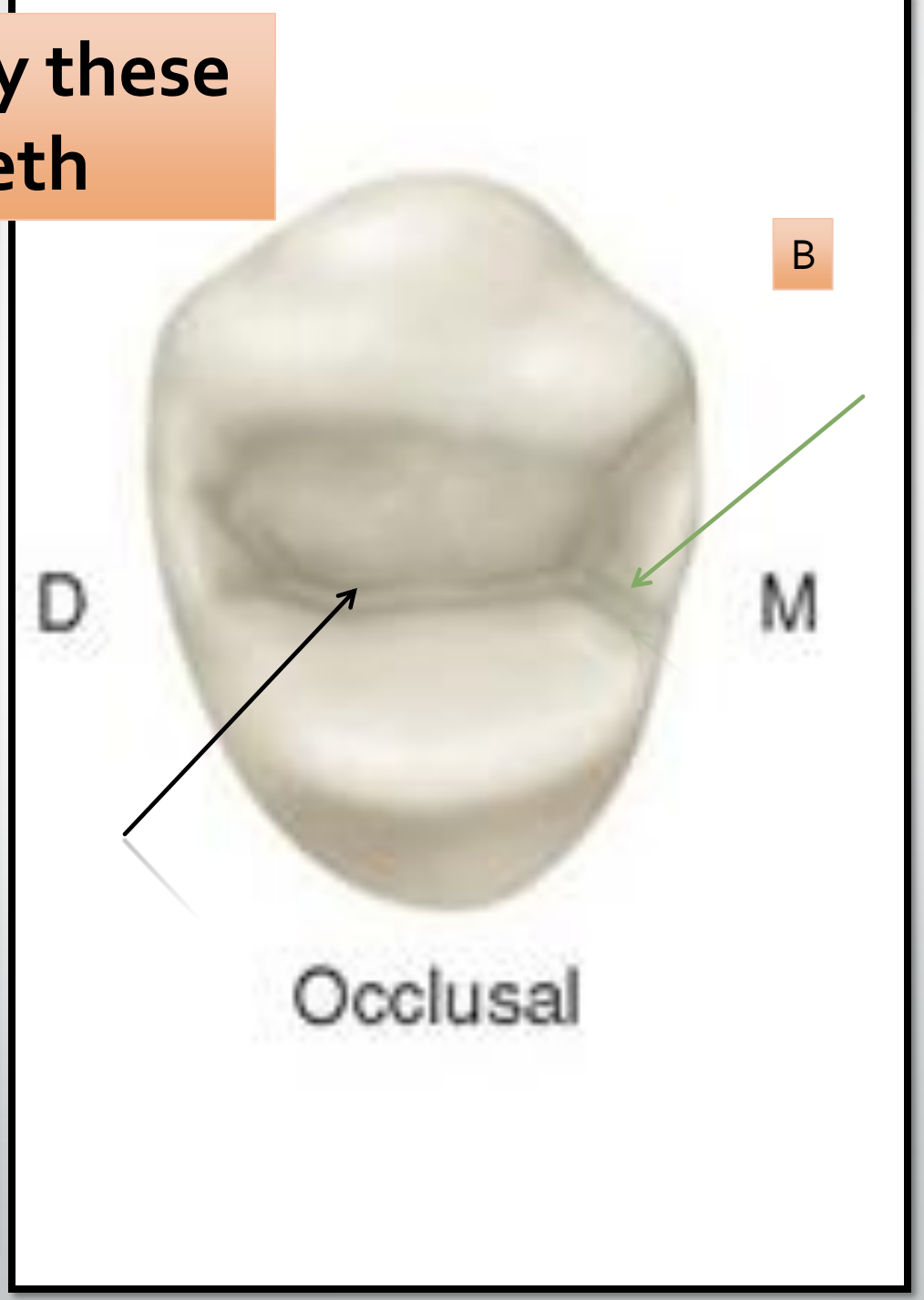
Clinical Case Questions

- **A 45-year-old patient presents with a caries in deep mesial marginal developmental groove extending onto the crown. Which tooth is most likely affected?**
- A. Maxillary first premolar
- B. Maxillary second premolar
- C. Mandibular first premolar
- D. Mandibular second premolar

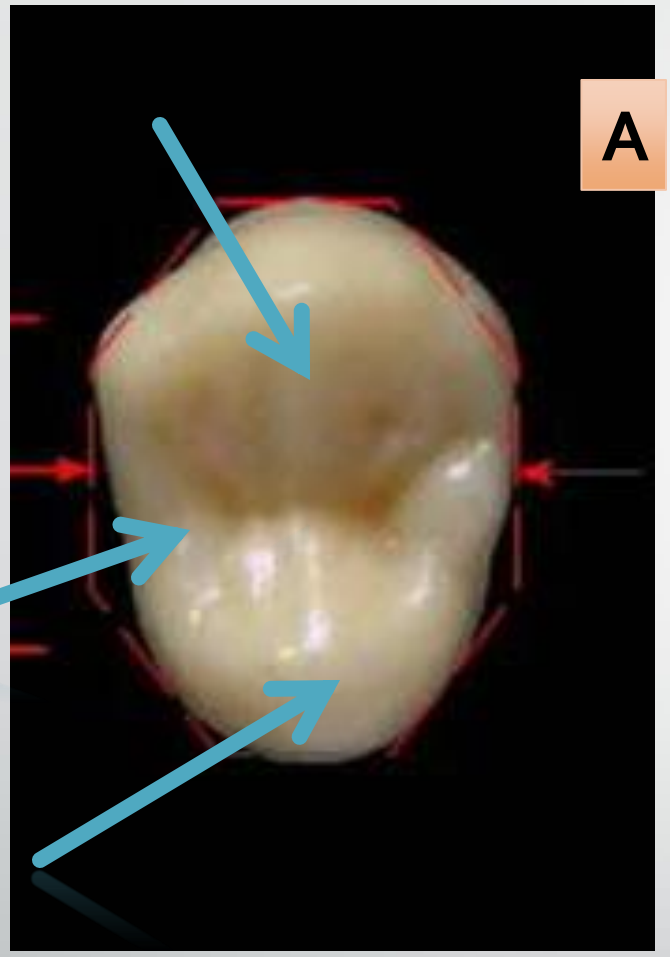
- **A dentist notes that a premolar's buccal cusp is not as pointed, and its occlusal surface has many supplemental grooves. Which tooth is it most likely to be?**
- A. Maxillary first premolar
- B. Maxillary second premolar
- C. Mandibular first premolar
- D. Mandibular second premolar

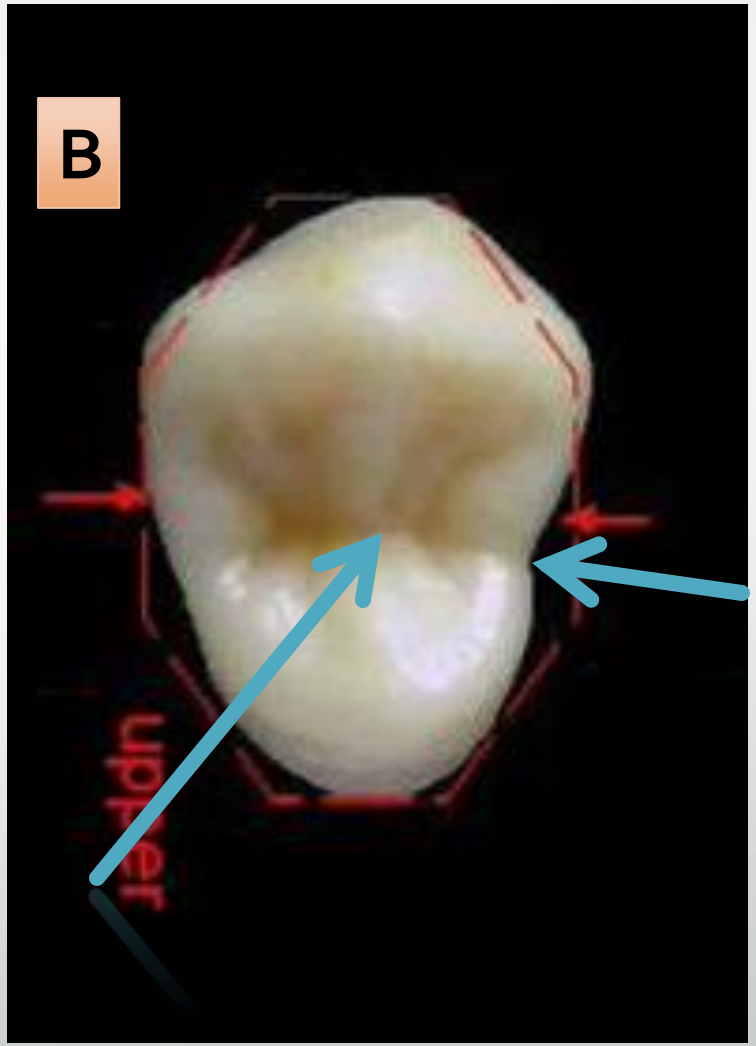
Identify these teeth





Identify the tooth

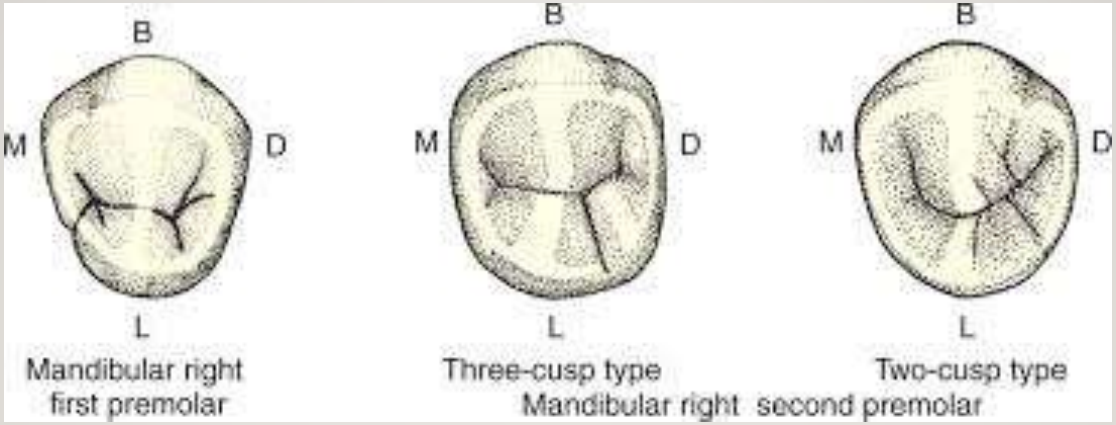




Thank You

Feeling gratitude and not expressing it is like wrapping a present and not giving it.

Mandibular Premolars



Mandibular right first premolar

Three-cusp type

Two-cusp type

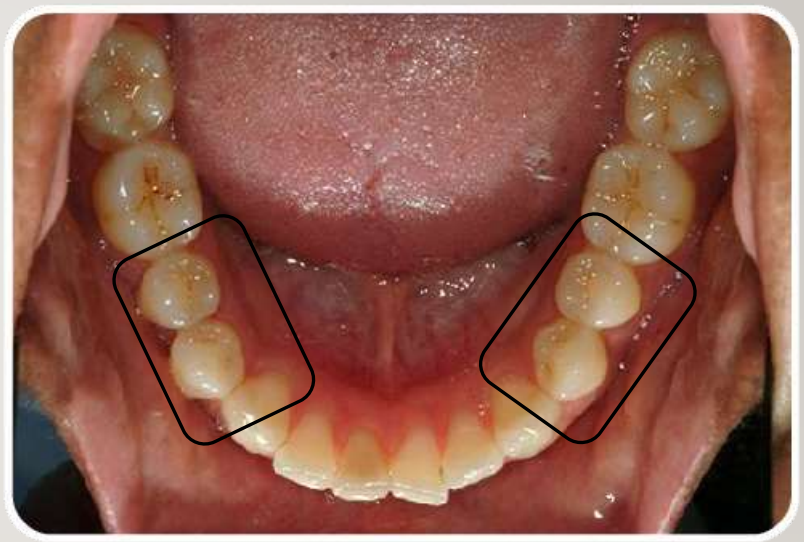
Mandibular right second premolar

Presented by:

Dr. Lina Helmy

How many mandibular premolars are found in each quadrant??

2 in each quadrant



The first premolar function is mainly ……..

Second premolar function in mainly……..

Mandibular First Premolar

It has 5 surfaces:

Buccal

Lingual

Mesial

Distal

Occlusal

The mandibular first premolars are developed from four lobes (3 facial and 1 lingual) similar to the maxillary premolars.

The first premolar has a large buccal cusp, which is long and well formed, with a small, nonfunctioning lingual cusp that is sometimes resemble the cingulum

It is situated between mandibular canine and mandibular second premolar. It has some characteristics common to each of canine & second premolar

The characteristics that resemble those of the mandibular canine are as follows:

1. The buccal cusp is long and sharp and is the only occluding cusp.
2. The occlusal surface slopes sharply lingually in a cervical direction.
3. (mesial cusp slope is shorter than distal cusp slope) in buccal cusp.

The characteristic similar to that of the second mandibular premolar is that:

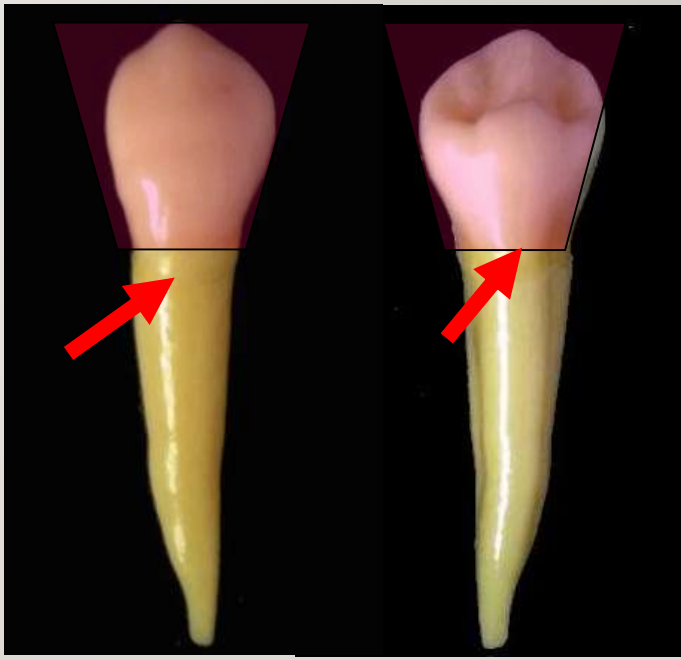
- The contact areas, mesially and distally, are almost near the same level, but distal still more cervical.

Buccal Surface

Geometric outline of the crown:

Buccal and lingual surface have trapezoid outline.

The smallest uneven side is cervically.



M slope shorter than D slope and both are concave

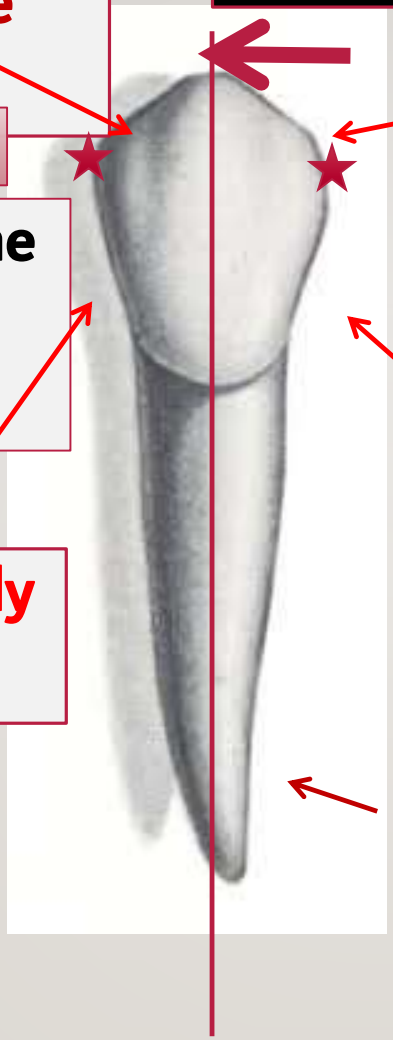
Cusp tip deviated MESIALLY

M

D

Contact distally more cervically positioned.

Contact mesially at the junction of O and M 1/3



Distal outline nearly concave

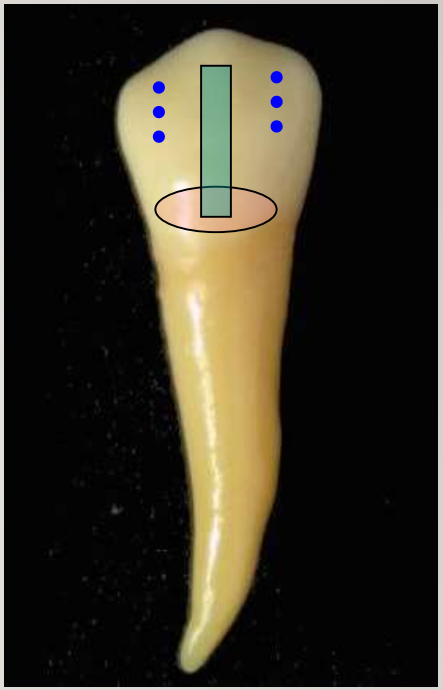
Mesial outline nearly concave

The root is cone shape with tapered distally curved apex.

Surface anatomy of the crown

Elevations:

- Cervical ridge (found in the cervical1/3).
- Buccal ridge (runs cevico-occlusally in the middle 1/3).



Depressions:

Two shallow depressions present mesial and distal to the buccal ridge.

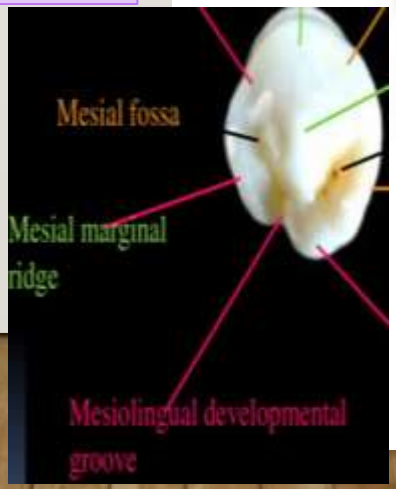
Lingual Surface

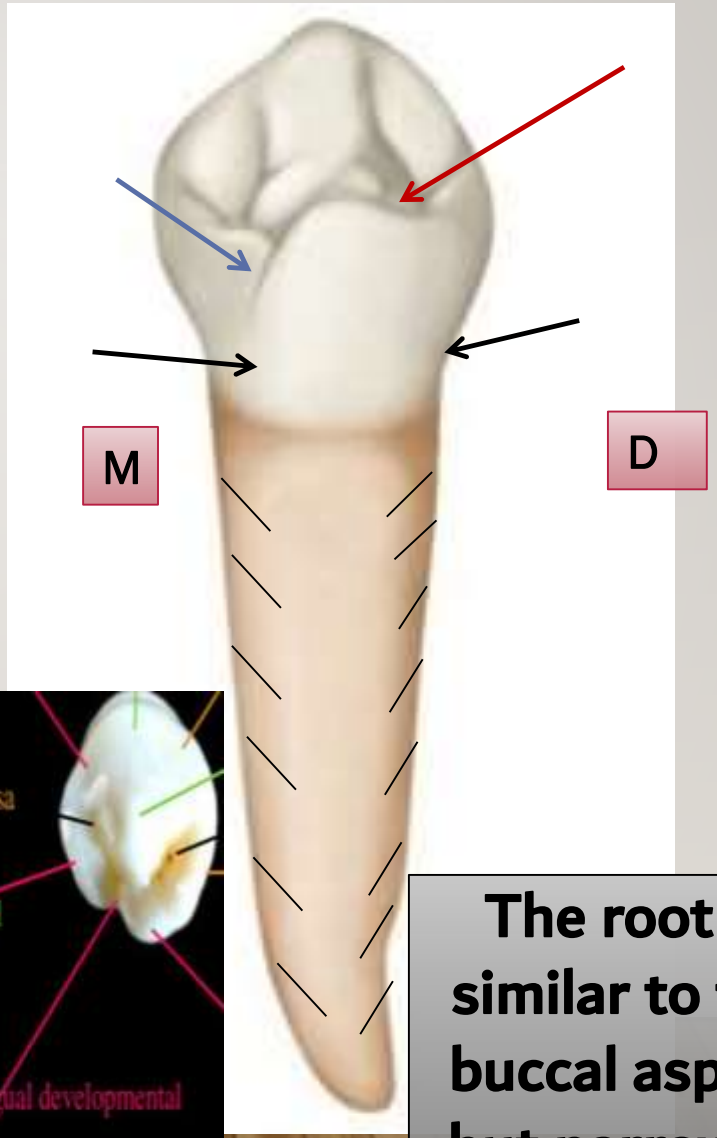
- **Severe** lingual convergence .

- The L cusp is **short and small** reaching 2/3 the crown length so most of the occlusal aspect could be seen.

- **Elevations:** The lingual surface is convex with the maximum convexity at middle 1/3.

Depressions: **Mesiolingual Developmental Groove** originates from the pit at the bottom of the mesial triangular fossa crossing the MesioLingual line angle.

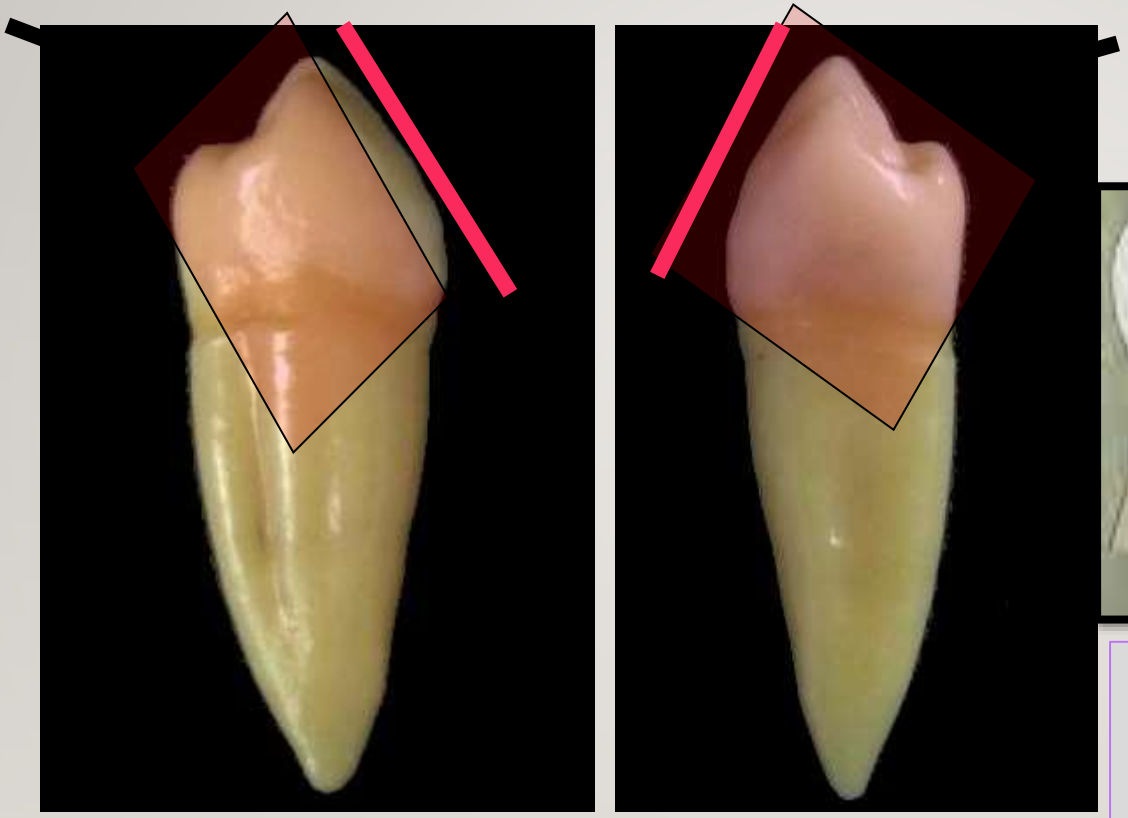


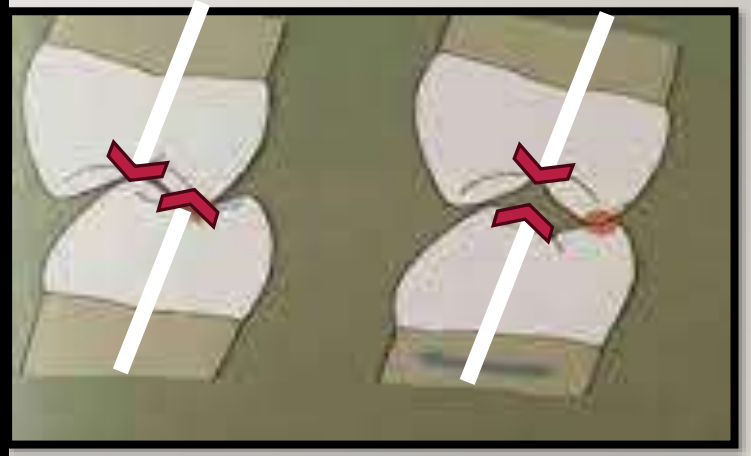


The root is similar to the buccal aspect but narrower

Geometric outline of the proximal surfaces

Distal surface Mesial surface





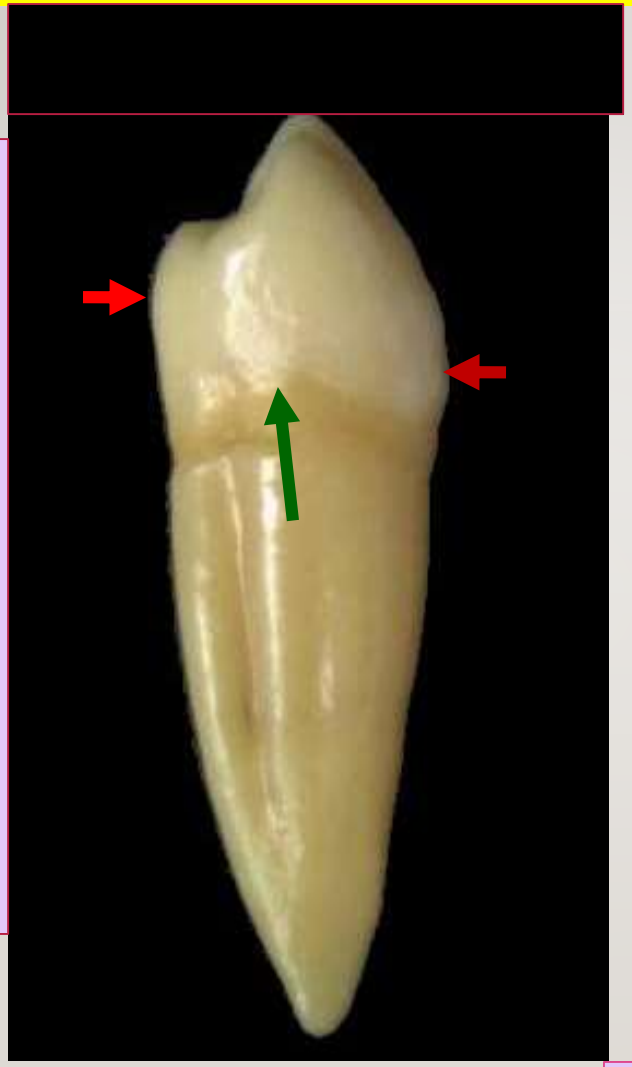
Significance of rhomboidal geometric outline in centric occlusion??

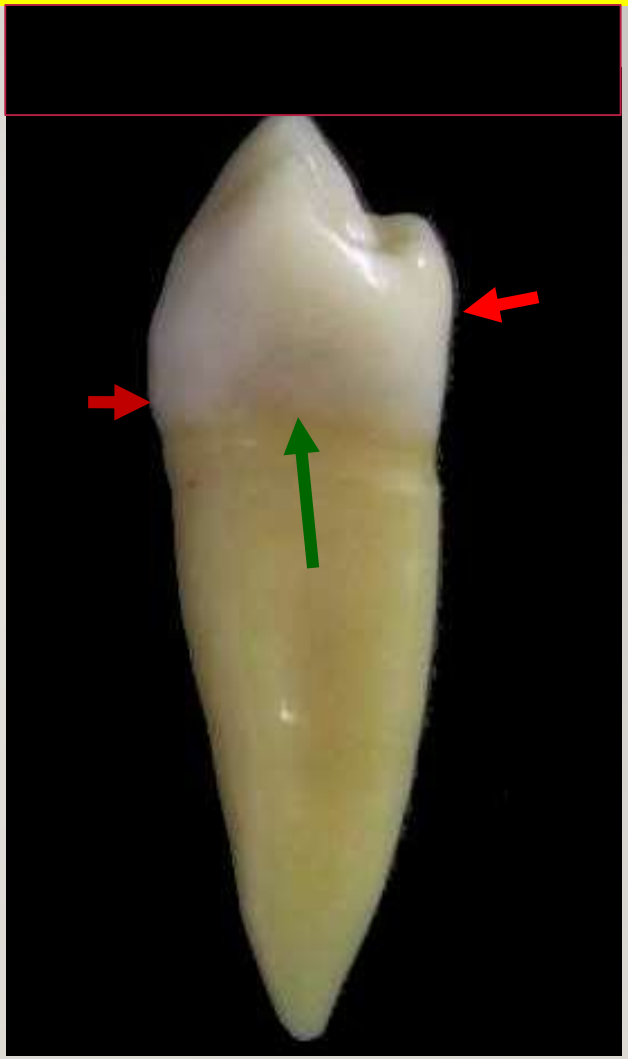
Rhomboid in shape with narrow occlusal table

Lingual inclination is well prominent

Outlines of proximal surfaces

Buccal outline is convex with the maximum convexity at Cervical 1/3 representing ...Cervical ridge ....





Lingual outline is convex with maximum convexity at ... Middle 1/3

Cervical line curves occlusally and more Cervically positioned distally

Mesial surface

Occlusal outline

The buccal cusp is centered above the root due to severe lingual inclination of the crown.

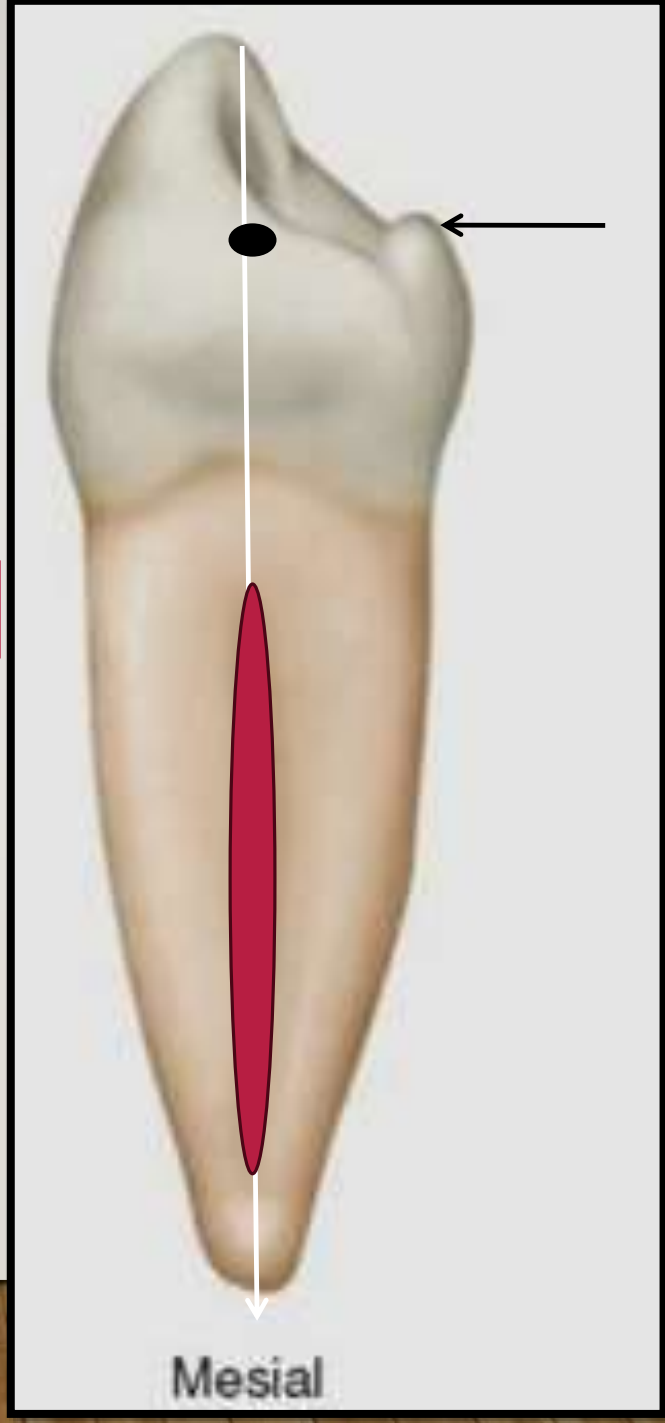
The lingual cusp is smaller &2\3 the buccal C.

Surface anatomy:

MMR severely sloping bucco-lingually ending with **mesiolinguual DG.**

Mesial contact area presents on midline buccolingual and at ..... Cervico-occlusal.

The root is wide and has **deep groove** with tapered end.



Distal Surface

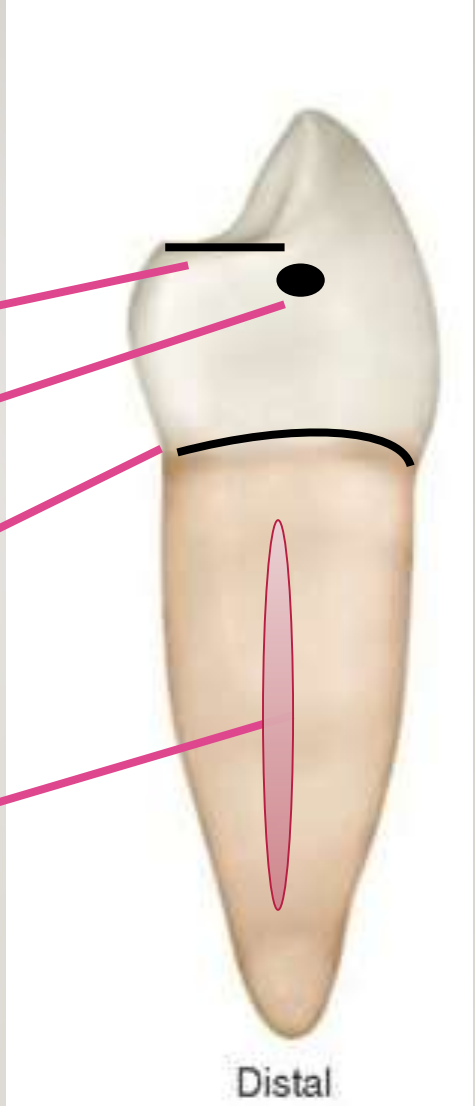
Differences with mesial surface:

1-DMR is perpendicular to long axis of the tooth.

2- Broader than the mesial

3- The curvature of the cervical line distally less curvature than mesially.

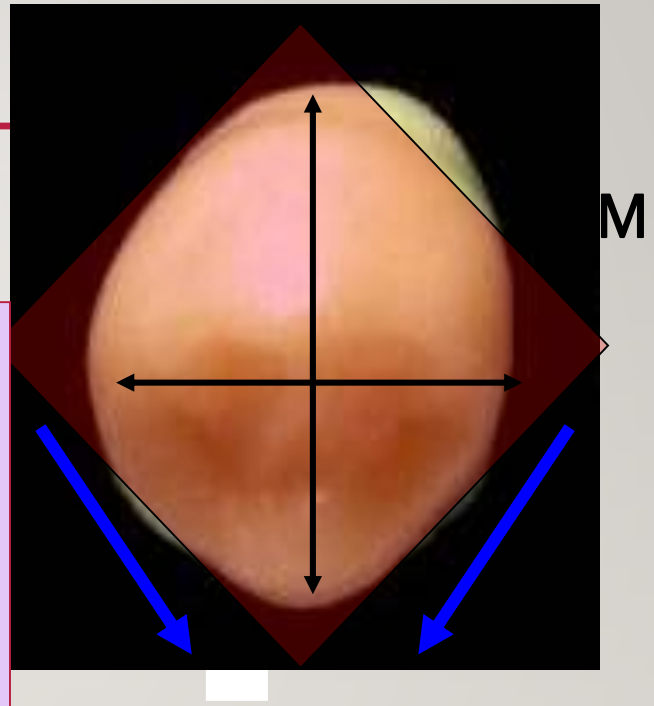
4-Deeper groove on the root.



Occlusal Surface

Geometric outline

Diamond-shaped



Buccal surface is much larger than Lingual surface
(due to sharp and severe lingual convergence)

Crown thickness is wider than width

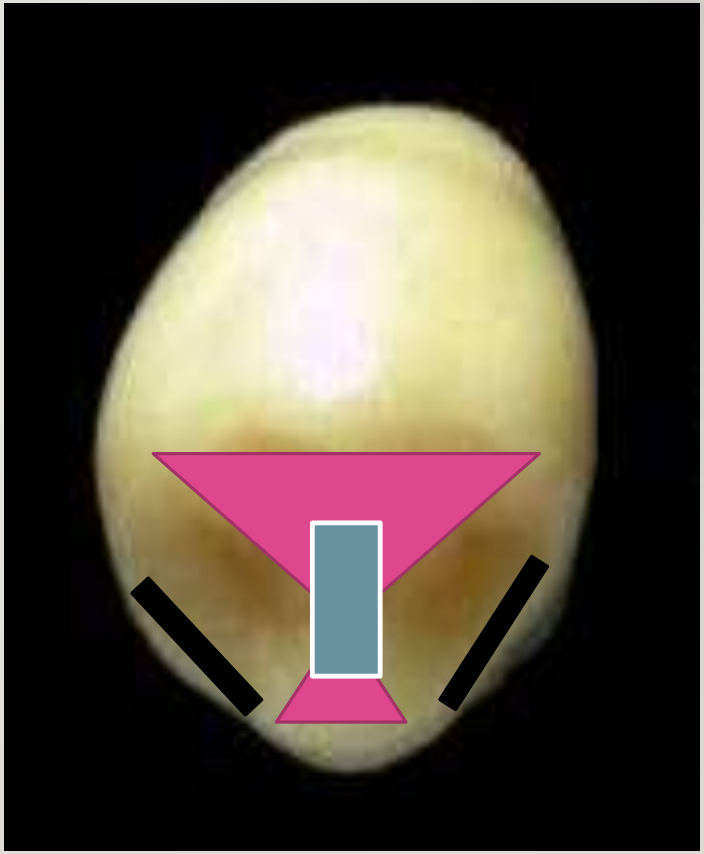
Surface anatomy of occlusal aspect

Elevations:

- Buccal triangular ridge
- Lingual triangular ridge

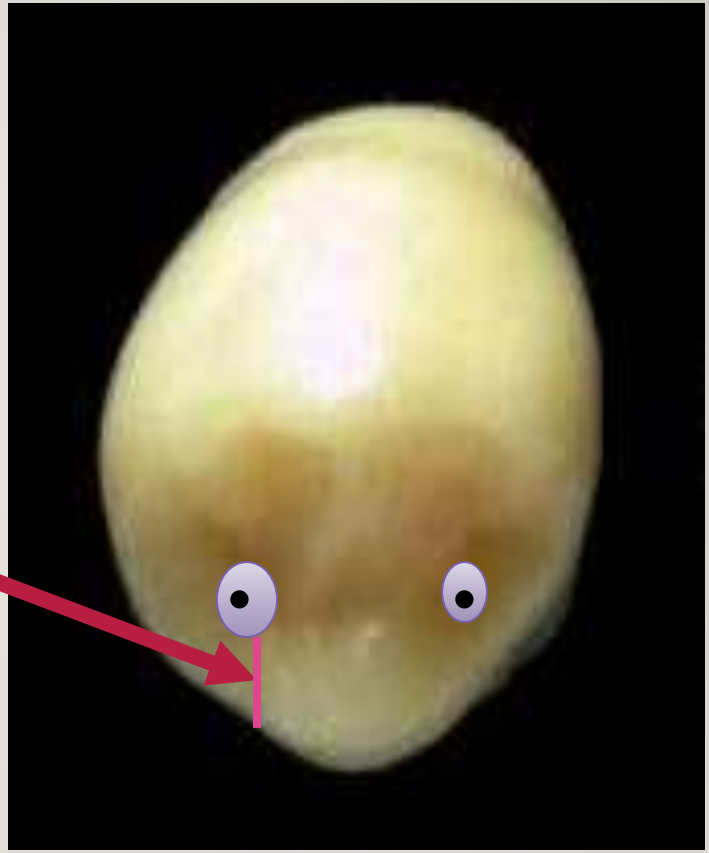
Who's larger??

- Transverse ridge connecting the two cusps triangular ridges.
- Mesial and distal marginal ridges



Depressions:

- Mesial and Distal rounded fossae (snake eyes).
- Mesiolingual developmental groove from
- Mesial developmental pit.
- A distal developmental pit with accessory supplemental grooves radiating from it

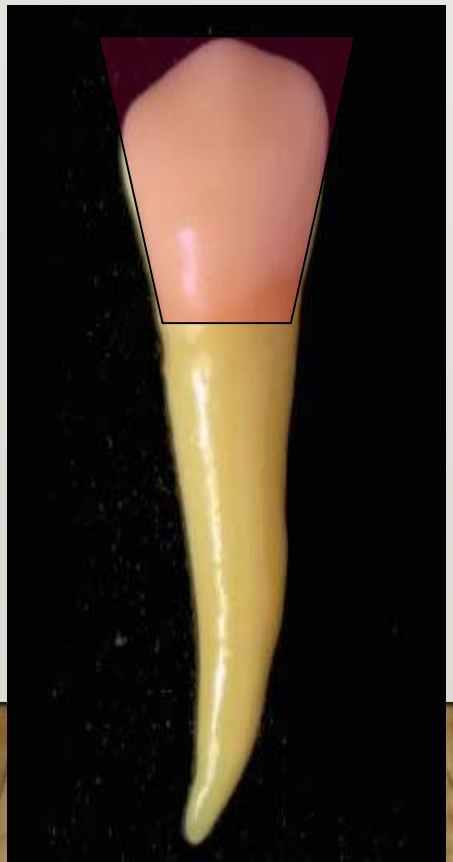


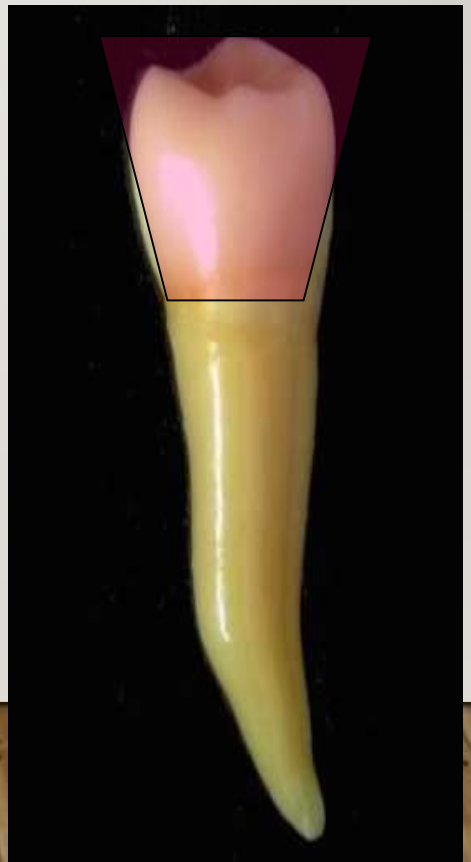
Mandibular Second Premolar

The mandibular second premolars the three cusps type are developed from five lobes, three buccal and two lingual lobes.

Geometric outline of Facial and lingual aspects

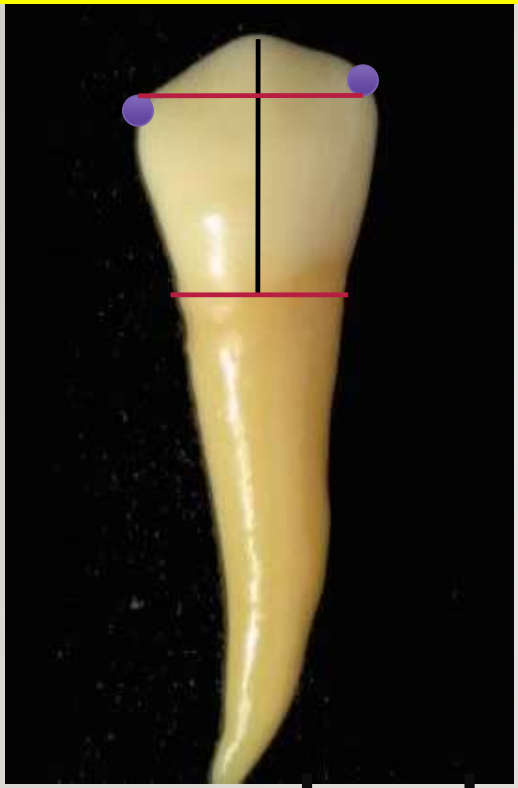
Trapezoid shape with the shortest uneven side cervically.



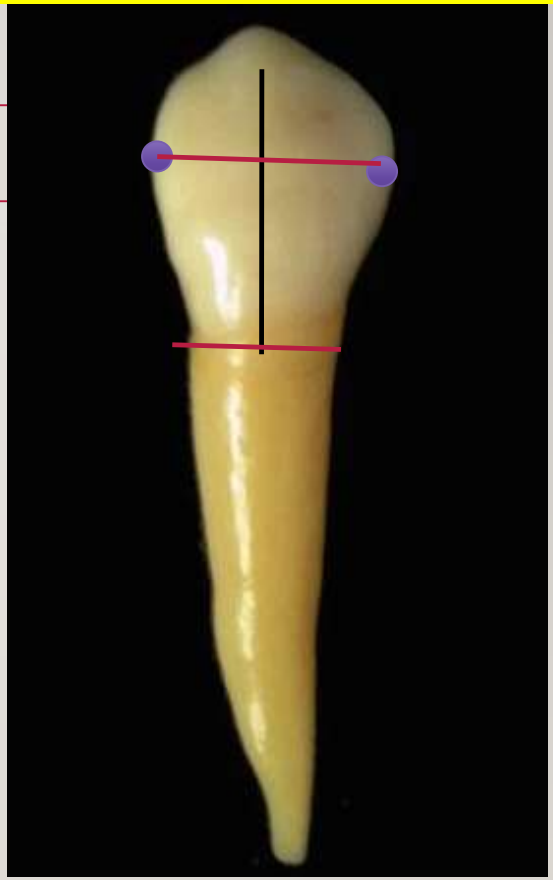


Buccal Surface

5



4



- Wider crown , broader neck but shorter.
- Buccal cusp shorter and less pointed.
- Mesial & Distal contact area more occlusally located.
- Buccal ridge less developed.

Lingual Surface

5

Either one or two lingual cusp

Lingual cusp is nearly equal to Buccal cusp (longer than of 4)

4

Slight lingual convergence.

The surface is convex with max. convexity at Occlusal 1/3.

Lingual Surface

5

4

If two lingual cusp, they are named Mesiolingual and Distolingual cusps.

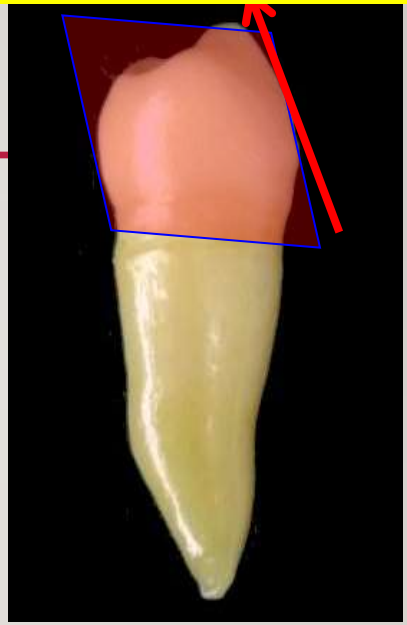
ML cusp is larger than DL cusp

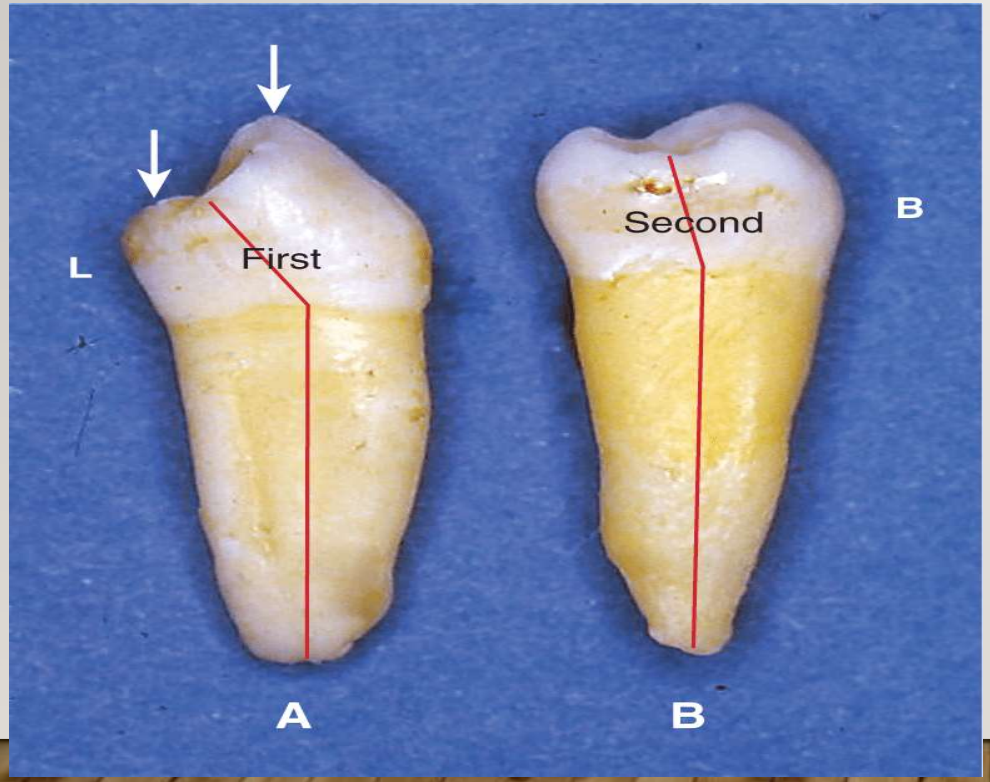
They are separated by Lingual DG

Proximal Surfaces

In comparison to lower 4

5





- Geometric outline is Rhomboid
- Less prominent lingual inclination

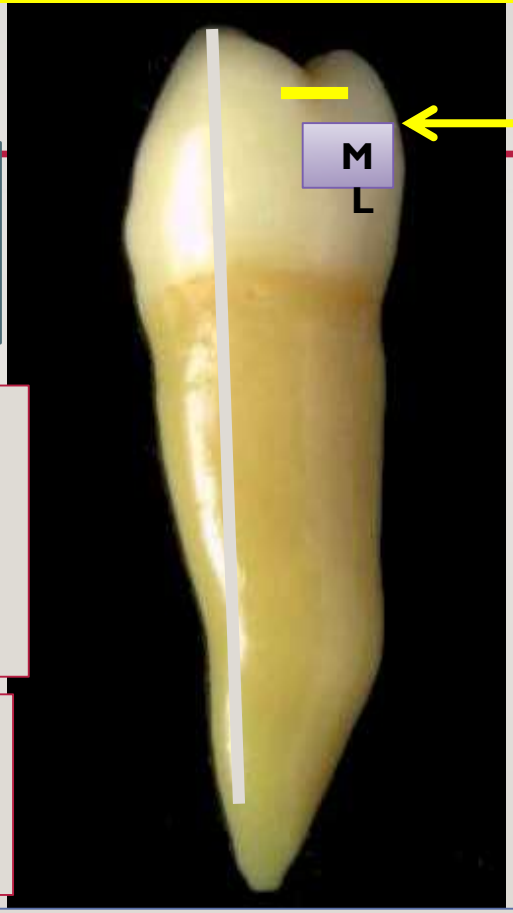
Mesial Surface

5

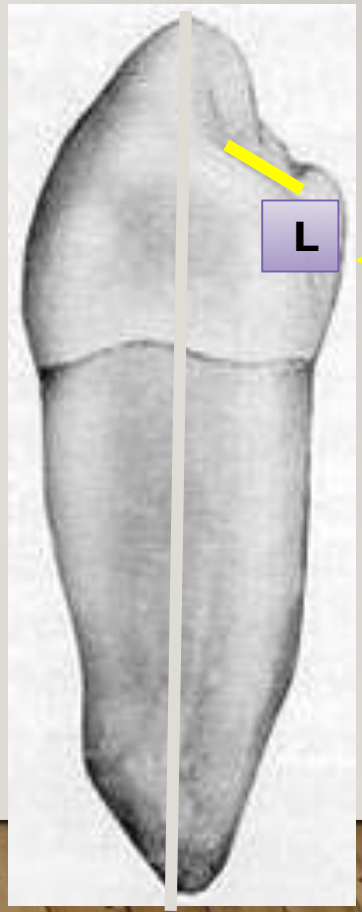
Lingual Maximum convexity at Occ. 1/3

ML cusp equal or slightly longer than B cusp and larger than Ling. C of 4

The mesial marginal ridge straight



4



Buccal cusp (less pointed) tip on the line with junction of buccal & middle 1/3 of the root.

Distal Surface

Similar to Mesial aspect except:

DL cusp is shorter and smaller than ML cusp.

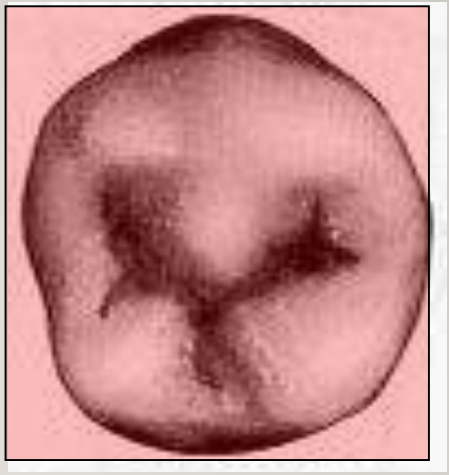
Mesial and Distal surfaces in 2 cusp type are similar to 3 cusp type (except 1 cusp seen lingually)

Surface anatomy is similar to that of $\frac{}{4}$ except absence of mesiolingual DG.

Occlusal Surface

Two cusp type

Geometric outline



Three cusp type

Round shaped

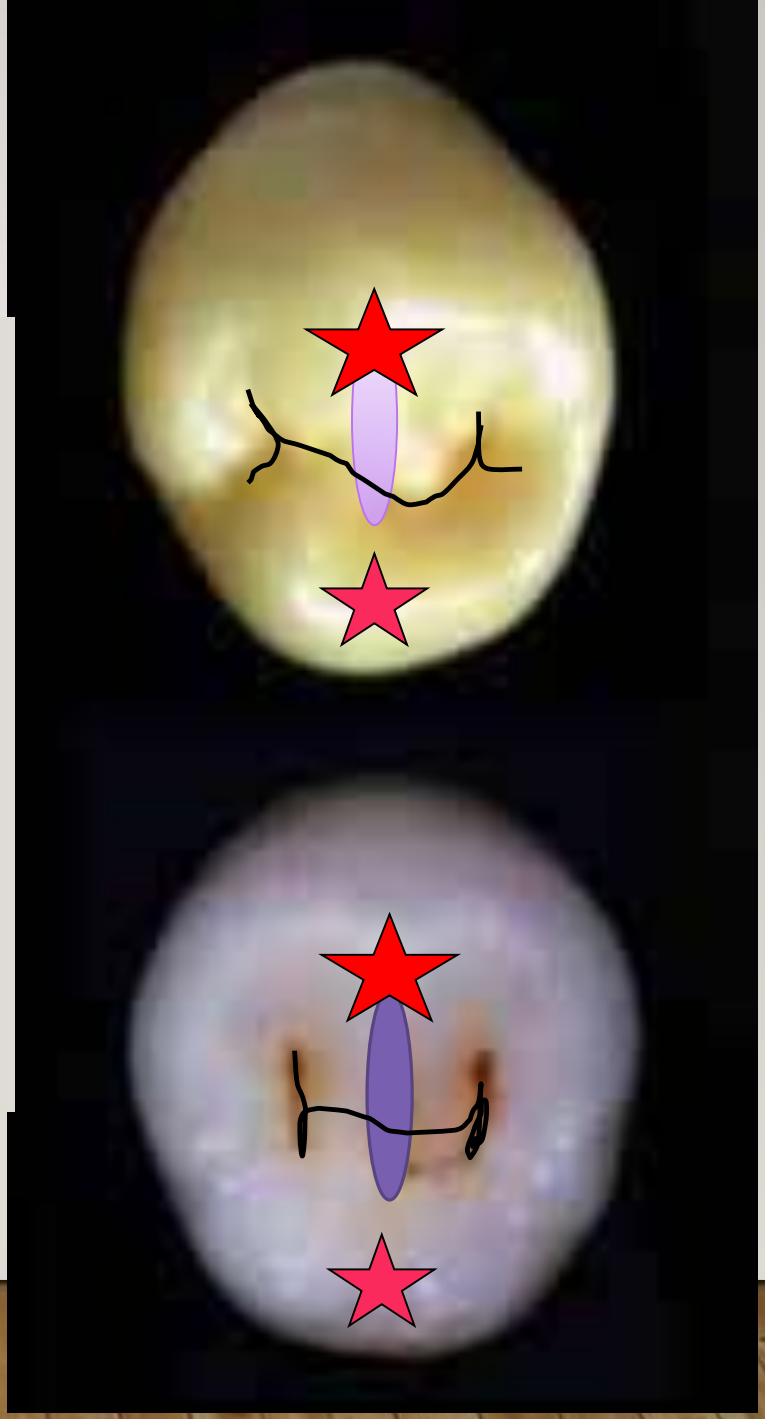
Slight lingual convergence

Square shaped

Absence lingual convergence.

Two cusp type

- **Buccal cusp triangular ridge** is larger than the **lingual cusp ridge.**
- **Transverse ridge** runs in the middle joining the two triangular ridges.
- The **central groove** is U or H shape grooves pattern.



Three cusp type

Elevations:

D

M

-Buccal triangular ridge. (largest)

-Lingual triangular ridges (ML &DL).

(Which is larger???)

Well developed M & D marginal ridges

Depressions:

-Central Developmental grooves Y-shaped (MB, DB & lingual developmental groove)

-Central fossa

-M and D triangular fossae

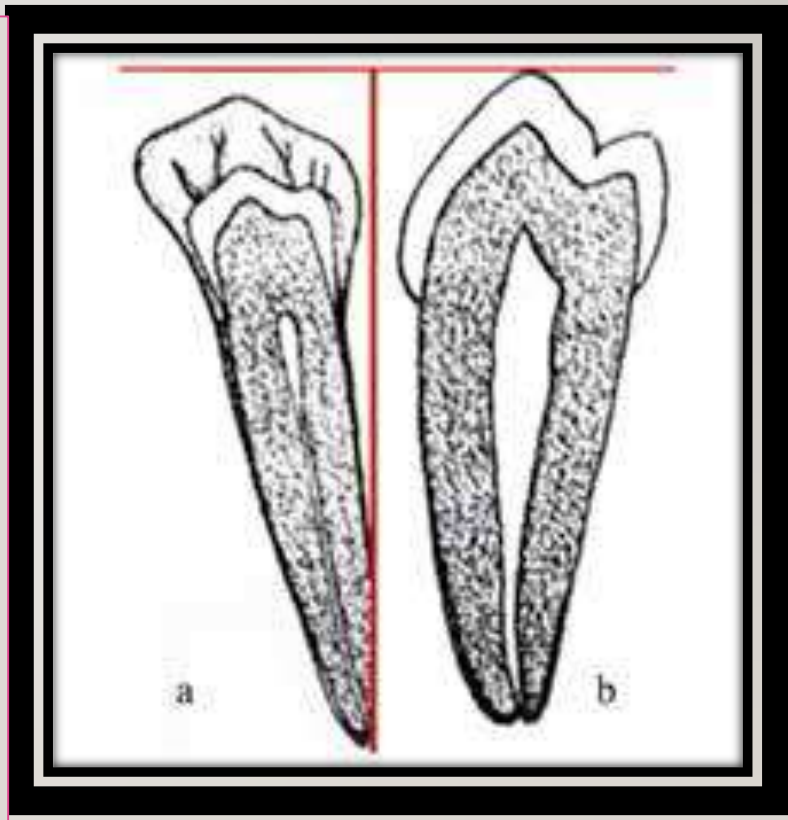
Pulp cavity of Lower Premolars

Mesio-distally:

- The pulp chamber is pointed occlusally with one pulp horn buccally and one pulp horn lingually (two pulp horns lingually in 3 cusp type lower 5).
-The root canal tapers to the apex.

Bucco-lingually:

- The pulp chamber has two pulp horns, buccal & lingual OR buccal & mesiolingual or distolingual.
- The root canal tapers to the apex.



Chronology of Premolars

	Beginning of calcification	Crown completion	Eruption	Root Completion
4 4	1½- 1¾ y. 1¾- 2 y.	3-4 y. before eruption date	10 10	3-4 y. after eruption date
5 5	2-2¼ y. 2¼-2½ y.		11-12 11-12	

Comparison Lower First Vs. Second Premolars

Feature	Lower First Premolar	Lower Second Premolar
Occlusal outline	Diamond-shaped	Square (3 cusp)or oval (2 cusps type)
Number of cusps	2 cusps (large buccal, small lingual)	2 or 3 cusps (1 buccal, 1-2 lingual)
Buccal cusp	Large, prominent and sharp	Less prominent, more rounded
Lingual cusp	Small, non-functional	Larger, functional
Occlusal surface	Prominent buccal ridge	Rounded, smoother
Mesial marginal ridge	Lower than distal marginal ridge and sloping, Mesiolingual Dev.groove present	Higher and more horizontal. No Mesiolingual Dev.groove
Root anatomy	Single root, sometimes bifurcated	Single root, rarely bifurcated
Root curvature	Often distally inclined	Straighter, less curvature

Clinical Difficulties in Mandibular Premolars

- Surgical Consideration:

1.Narrow Roots: Risk of fracture during extractions.
2.Mental Foramen Proximity: Risk of nerve injury.

CLINICAL CASE QUESTIONS

- **A 35-year-old patient presents with a caries in mesiolingual developmental groove extending onto the line angle. Which tooth is most likely affected?**
- A. Maxillary first premolar
- B. Maxillary second premolar
- C. Mandibular first premolar
- D. Mandibular second premolar

- **A 2-5year-old patient presents with caries. The dentist found severe lingual tilt on the occlusal surface complicating restoration. Which tooth is most likely affected?**
- A. Maxillary first premolar
- B. Maxillary second premolar
- C. Mandibular first premolar
- D. Mandibular second premolar

Questions:

1.How many lobes form the mandibular first premolar?

Answer: _____

2.Which cusp is nonfunctioning in the mandibular first premolar?

Answer: _____

3.What is the geometric outline of the proximal surfaces of mandibular premolars?

Answer: _____

4.Which mandibular premolar often has three cusps?

Answer: _____

5.On which premolar do 'snake eyes' pits appear?

Answer: _____

6.Which is the largest lingual cusp in the mandibular second premolar (3-cusp type)?

Answer: _____

7.What is the shape of the occlusal outline of the mandibular first premolar?

Answer: _____

8.In which mandibular premolar is a Y-shaped central groove seen?

Answer: _____

9.What is the pulp horn configuration in the mandibular second premolar (3 cusps)?

Answer: _____

10.How is the mesial marginal ridge oriented in the mandibular first premolar?

Answer: _____


Good Luck

Maxillary First Permanent Molar

PRESENTED BY LECTURER DR.LINA HELMY

General characterstics

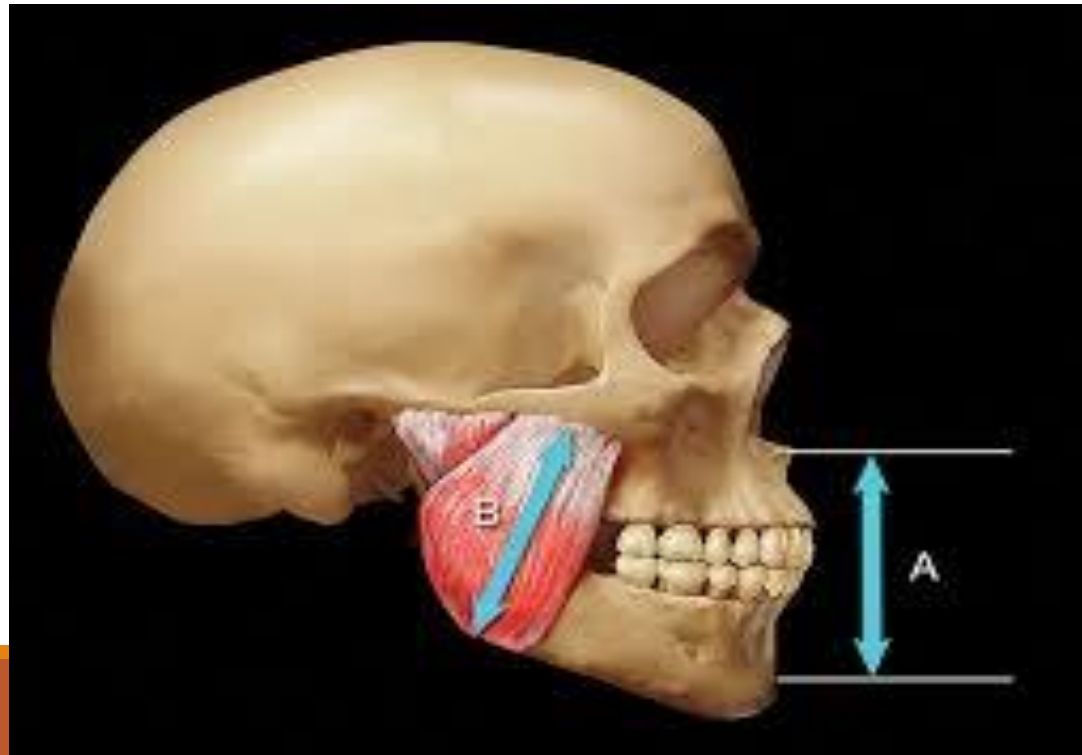
- There are 12 permanent molars (3 in each quadrant).
- They are the largest and strongest teeth in the mouth.
- They have no deciduous predecessors. They erupt distal to the deciduous molars.
- They are formed of 4 lobes except the lower 1st molar and in some cases of the lower 3rd molar when it has the 5 cusps as the lower first molar; formed of 5 lobes.
- They are multirooted teeth where the lower have two roots and the upper have three roots.

Functions of Molars

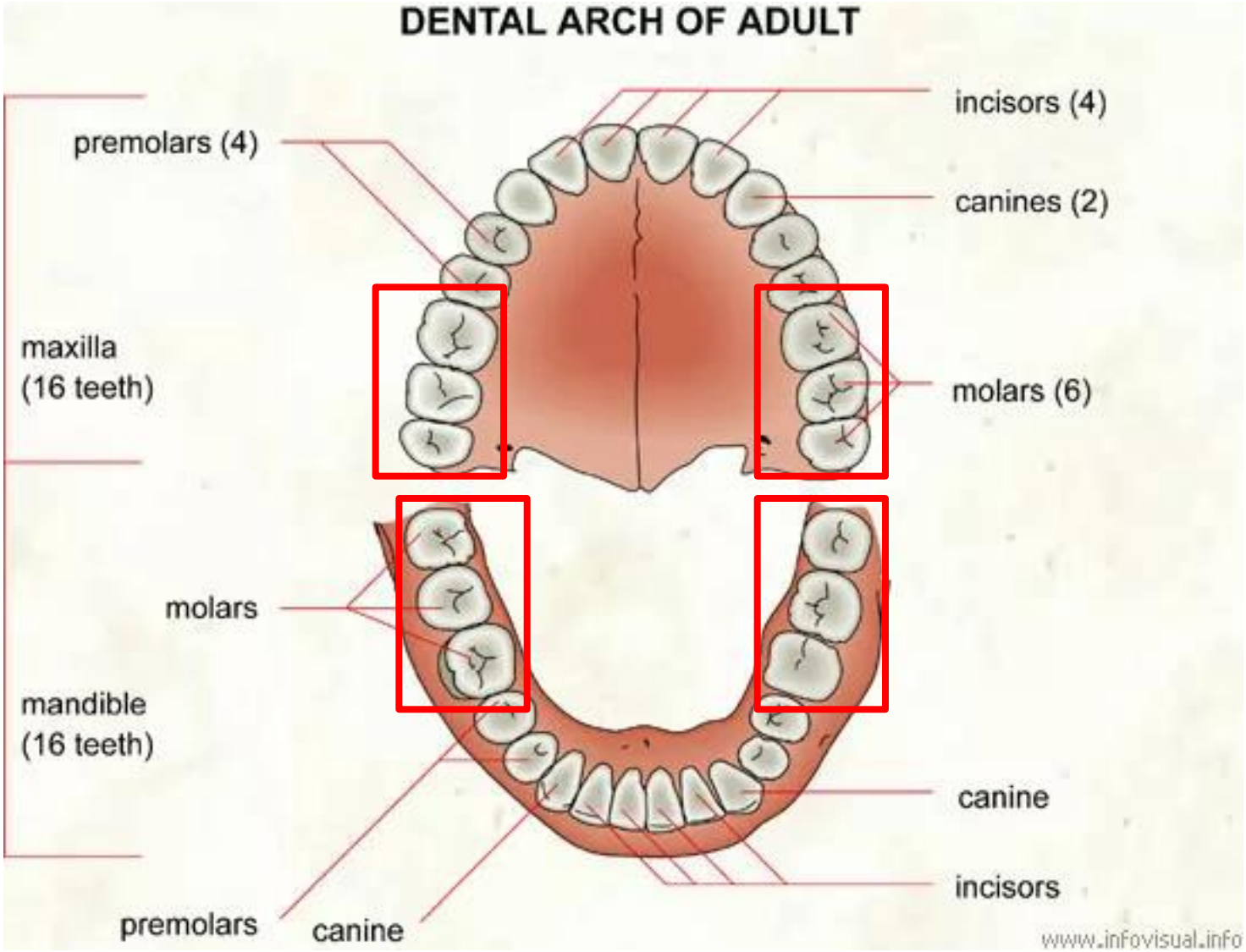
- Grinding food due to their wide occlusal surface and 4 or 5 cusps.

- They support muscles of mastication and cheeks.

- They maintain the vertical dimension .



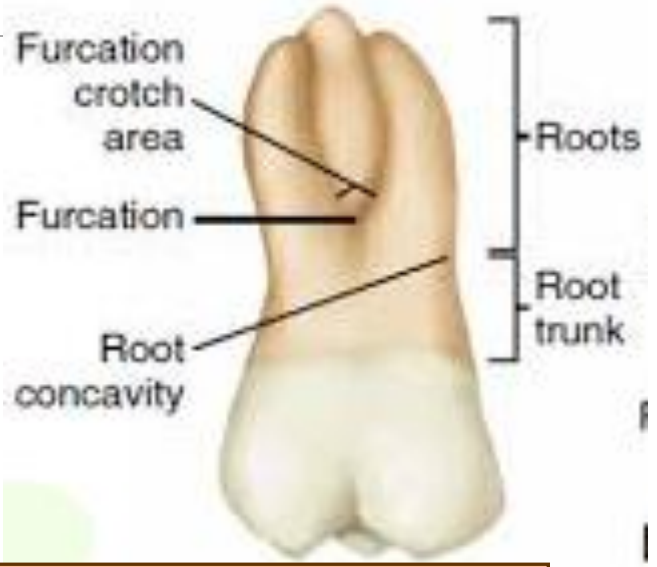
	Beginning of calc.	Crown completed	Eruption	Root completed
6	At birth	Minus 3-4 years	6y	+ 3 years
7	3y		12y	
8	7-9Y		18y	

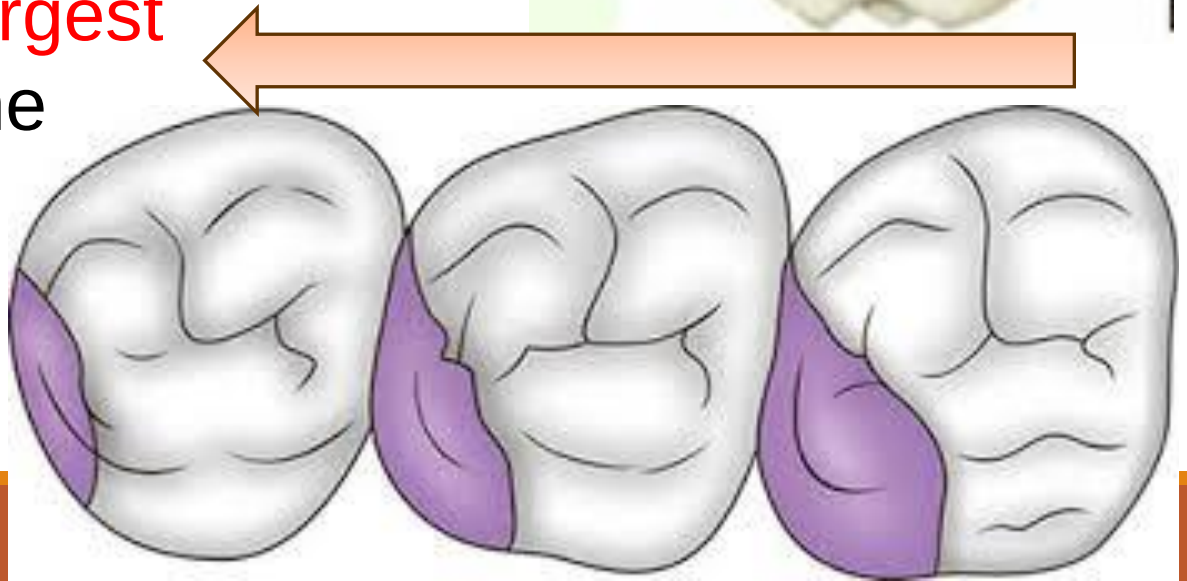

DENTAL ARCH OF ADULT
premolars (4)
incisors (4)
canines (2)
maxilla
(16 teeth)
molars (6)
molars
mandible
(16 teeth)
canine
incisors
premolars
canine
www.infovisual.info

Maxillary Molars

-They have 3 Roots , 2 Buccally and 1 Palatal.

-They Decrease in size as we go posteriorly so the first molar is the largest and third molar is the smallest .

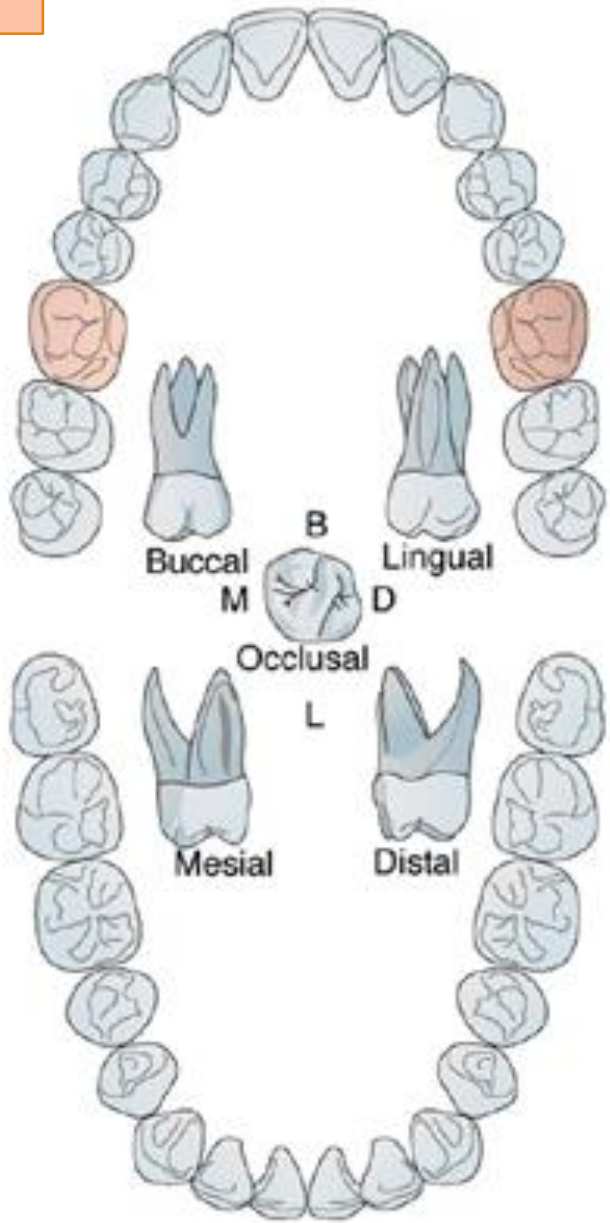




The Maxillary First Molar

-The crown of this tooth is **wider buccolingually** than mesiodistally (Thickness greater than width)

-The maxillary first molar is the **largest tooth in the maxillary arch**. It has four well-developed functioning cusps, and a **tubercle found on the ML cusp** that is distinctive to the upper 6.



Maxillary first molars

No. of surfaces

It has five surfaces .

Buccal

Lingual

Mesial

Distal

No. of roots

It has three roots (two buccal and one palatal).

Occlusal

The buccal aspect

1-Geometrical outline

Trapezoid in shape.

-The short side cervically.

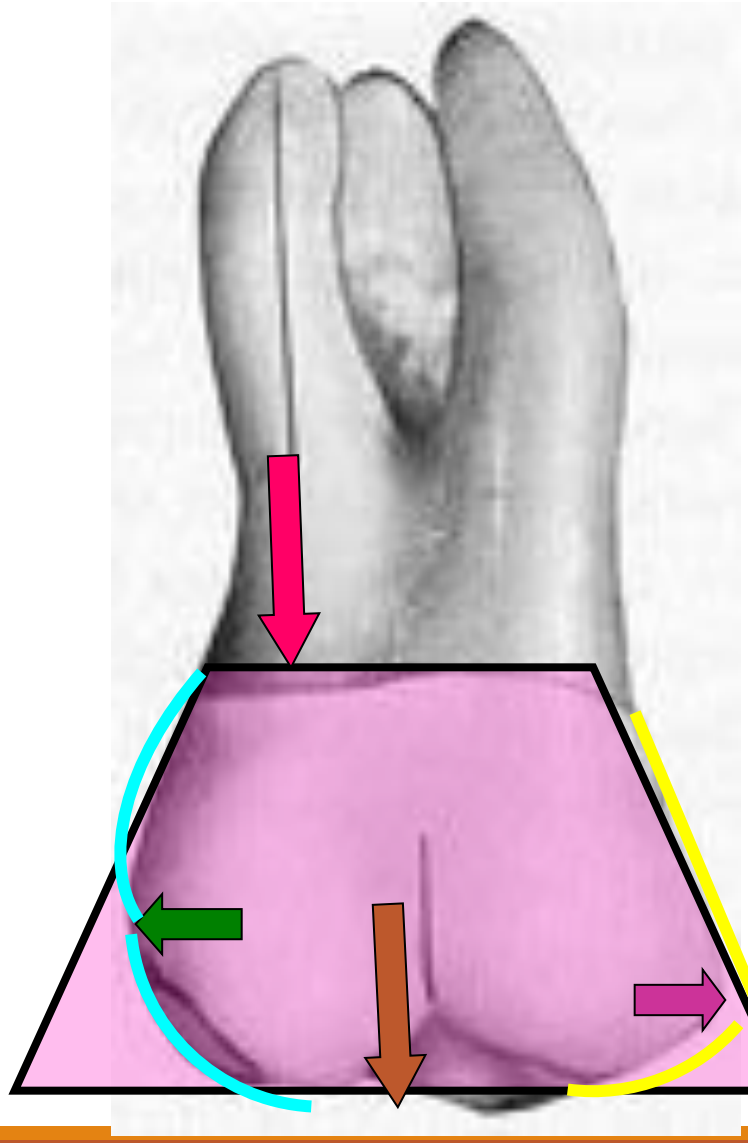
-The long side occlusally.

2- Mesial outline is straight till the contact area (at the junction of occ. and middle 1/3s).

- Then become convex for the mesial slope of the mesio-buccal cusp.

3- The distal outline is convex till the contact area at the middle third.

- Then become convex for the distal slope of the disto-buccal cusp.

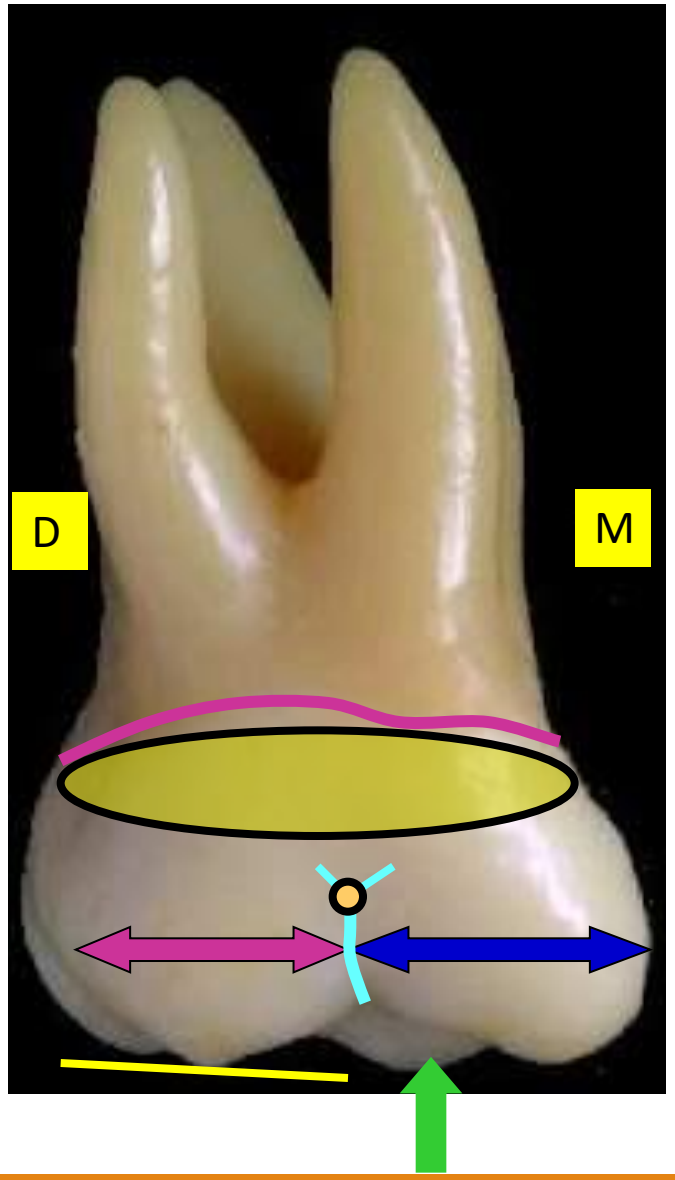


4- The cervical line is straight or slightly convex.

5- The occlusal outline: the mesiobuccal cusp is broader than the distobuccal cusp.

- The disto-buccal cusp is longer and sharper than the M.B.Cusp

- The mesio-lingual cusp can be seen between the two buccal cusps due to disto-buccal convergence .



6-Surface anatomy

- Cervical ridge.

- Buccal developmental groove extends to the middle of the buccal surface separates the two buccal cusps.

- The groove may fade out,

- Split into 2 shallow grooves. - Or end in a fault pit.

7- The root

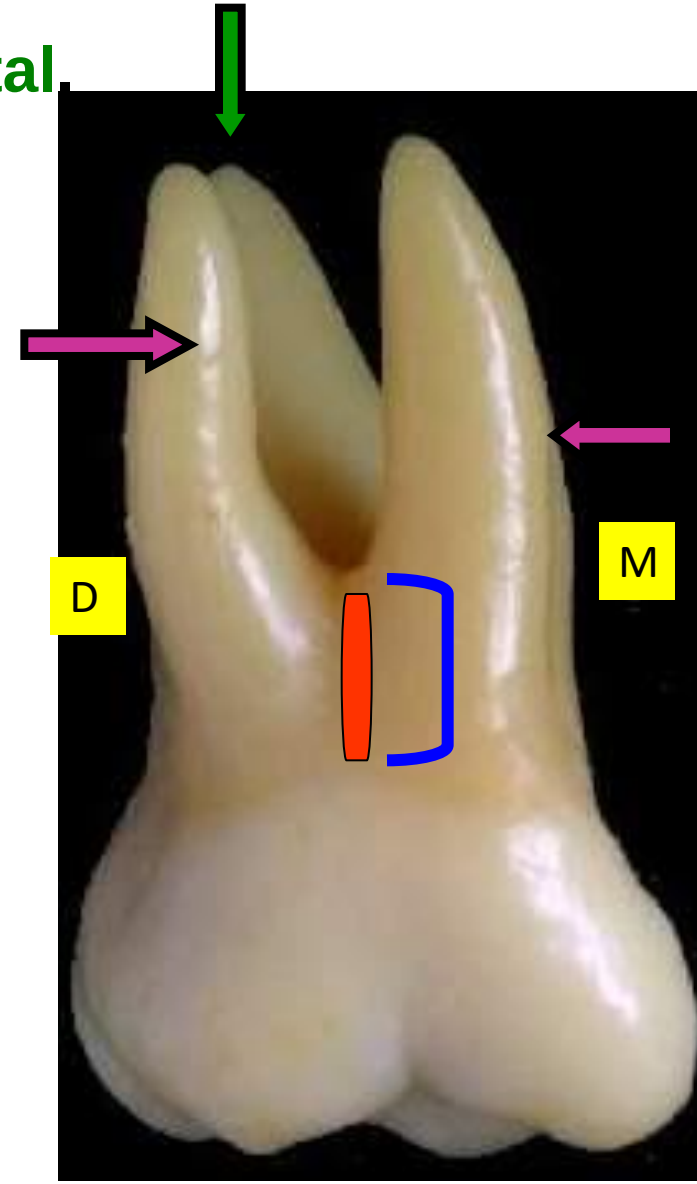
- Three roots two buccal and one palatal.

- The palatal root is the longest one and appear between the two buccal roots.

- There is root trunk at cervical third. It has developmental depression.

- The mesiobuccal root curves distally at the middle third.

- The distobuccal root curves mesially at the apical third.



Lingual aspect

- The geometrical outline and outline is similar to the buccal aspect.

- No lingual convergence.

-The mesiolingual cusp is larger than the distolingual cusp.

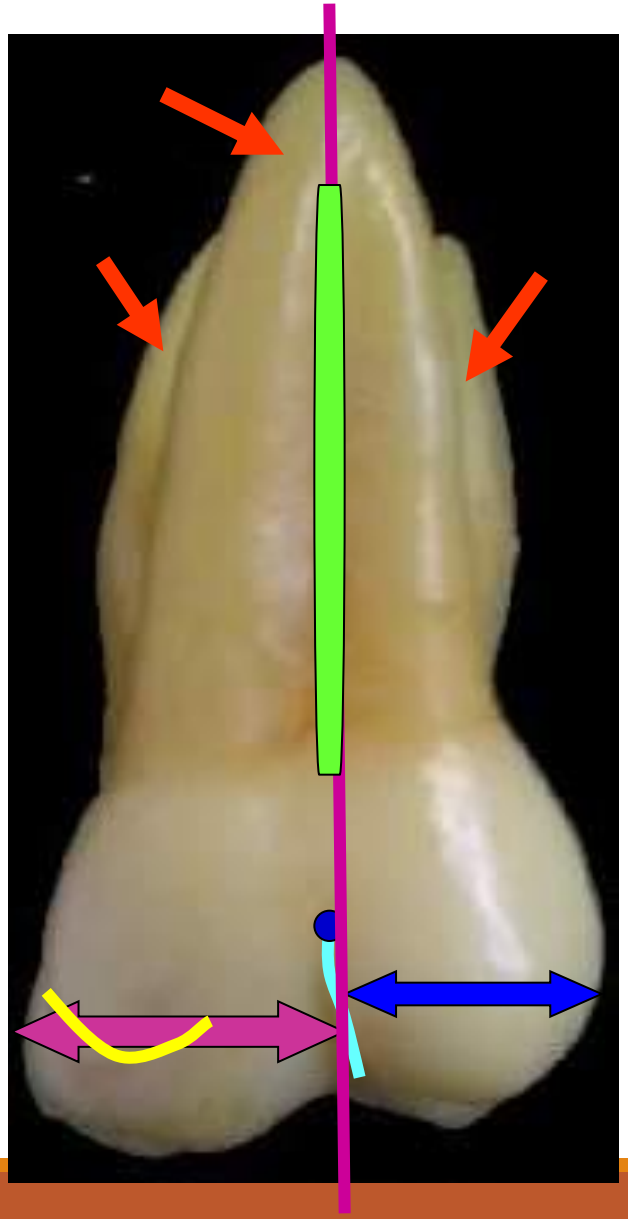
- The lingual developmental groove separates the two lingual cusps and may end in a pit.

- The lingual groove is in line with the palatal root apex.

- The three roots could be seen.

- The palatal root has developmental depression.

- Tubercle of Carabelli present on the mesiolingual cusp.



The mesial aspect

1-Geometrical outline

Trapezoid in shape.

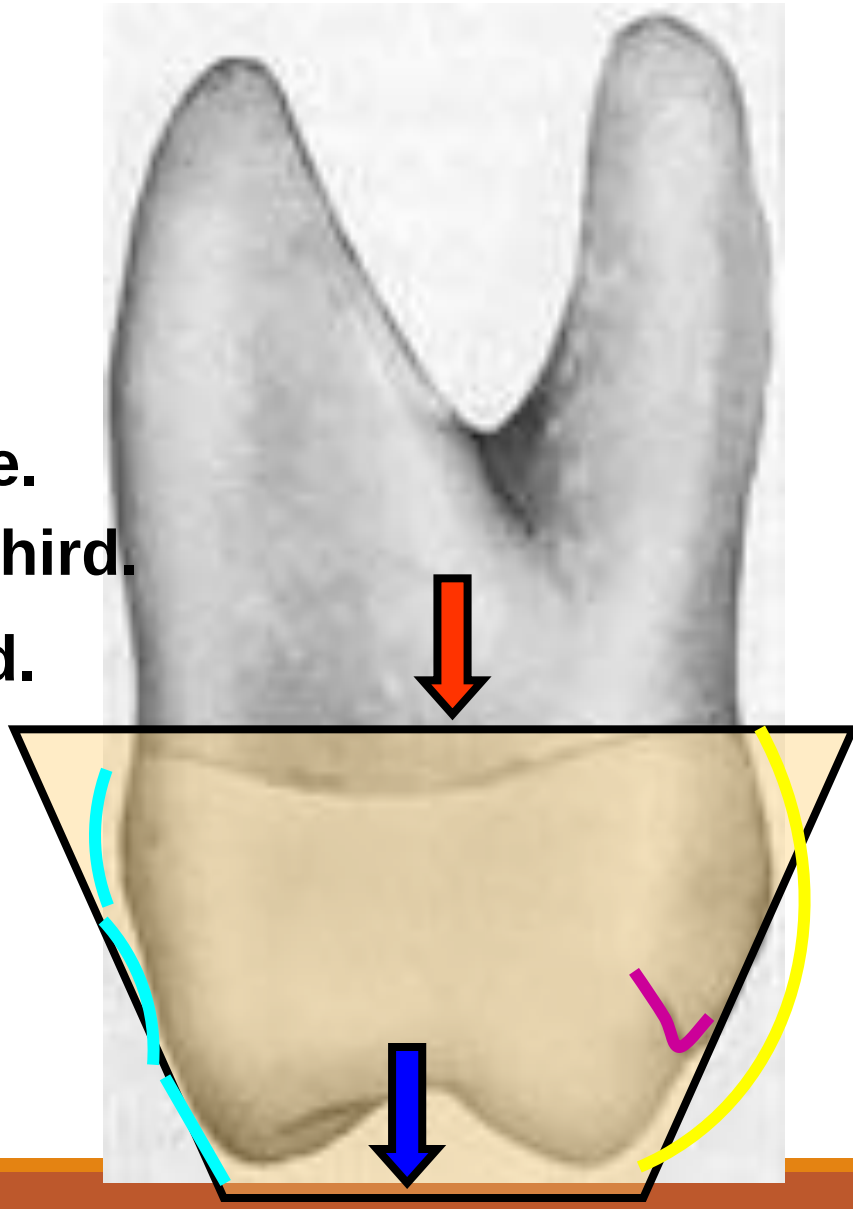
-The short side occlusally.

-The long side cervically.

2- The buccal outline is convex at cervical third for the cervical ridge.

- Then become concave at middle third.

- Then straight at the occlusal third.



3- The lingual outline is convex with the maximum convexity at the middle third.

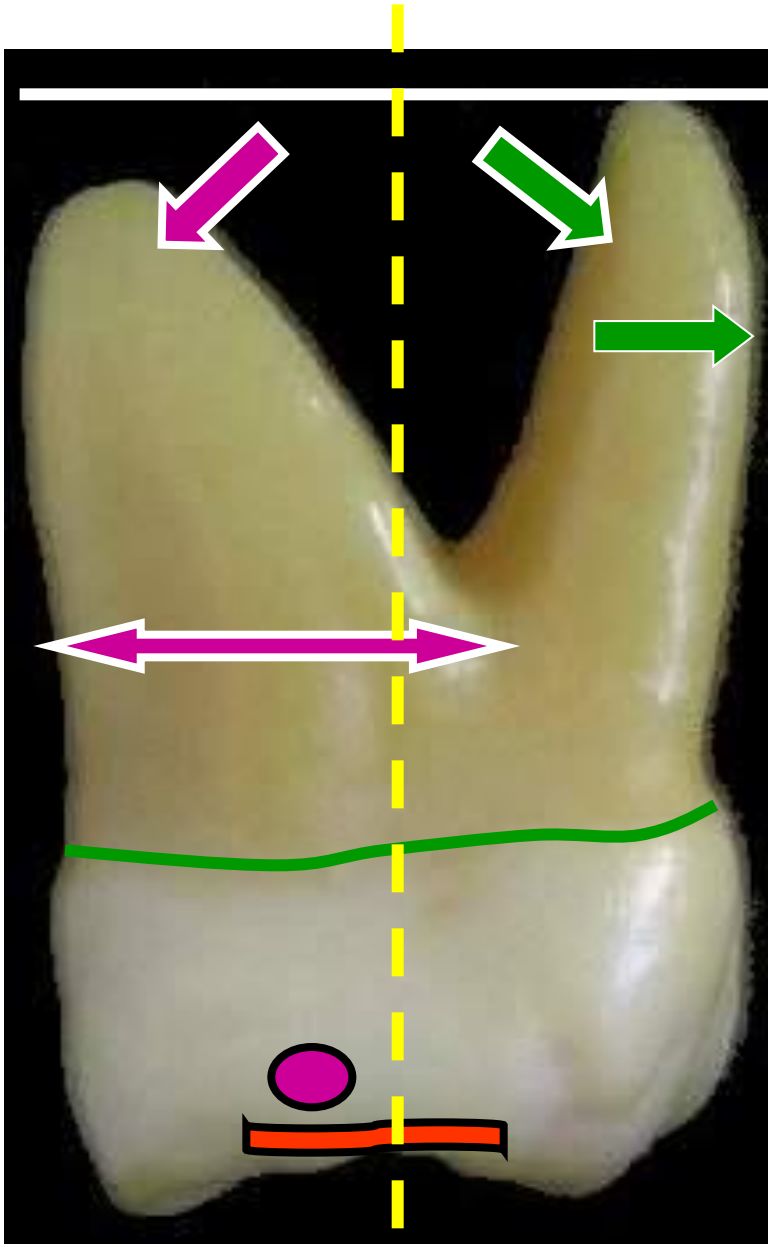
- The mesiolingual cusp has the tubercle of Carabelli.

4-Occlusal outline:

-ML cusp larger than MB cusp.

- The mesial marginal ridge is well developed.

5- The cervical line is shallow and curved occlusally.



6- Surface anatomy

- The contact area present at the junction of the occlusal and middle third and buccal to the midline.

7- The root

- Mesiobuccal and palatal roots.

- The palatal root is longer.

- The palatal root is convex; the crest of curvature at the middle third

- The mesiobuccal root has 2/3 of the root trunk.

The distal aspect

Similar to the mesial aspect
but differs in:

1- The crown converges distally.

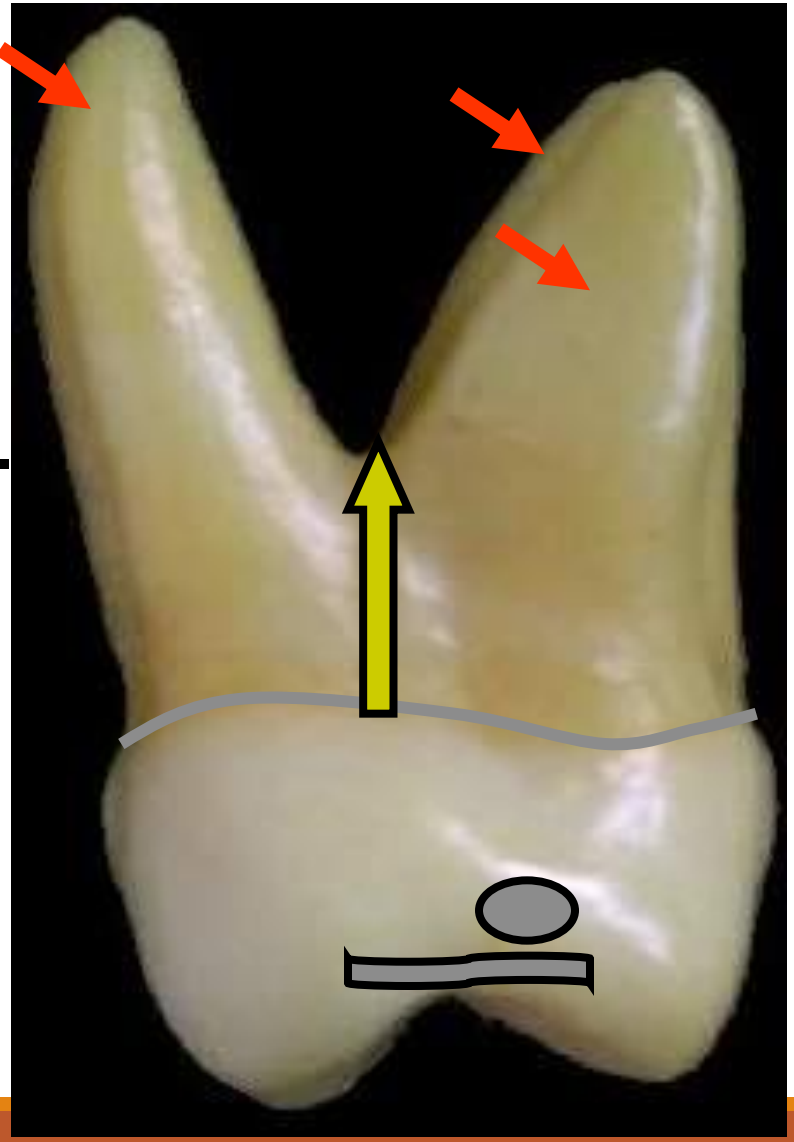
2- The distal marginal ridge is more cervically.

3- The cervical line is nearly straight.

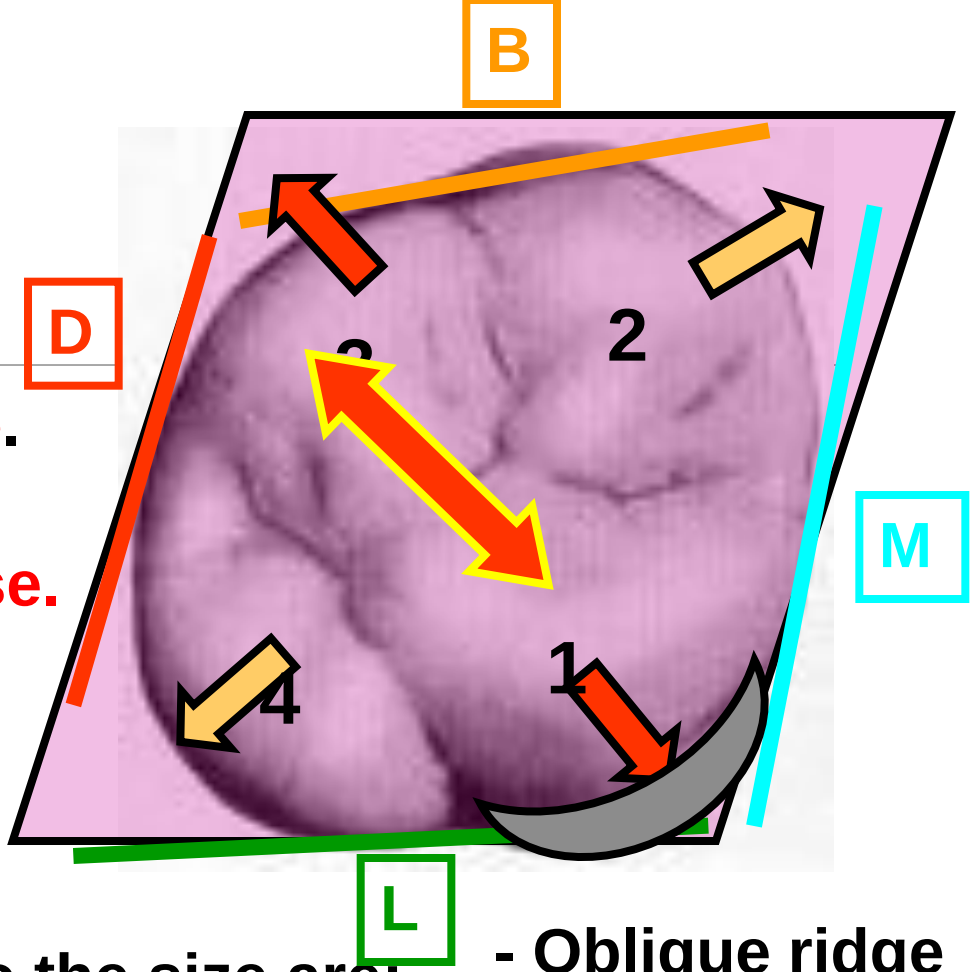
4- The contact area is broader than the mesial and located at the middle third.

5- The three roots could be seen.

6- The root trunk is longer than the mesial.



The occlusal aspect



- It is rhomboidal in shape.

♥ The mesiobuccal and distolingual angles are acute.

♥ The mesiolingual and the distobuccal angles are obtuse.

☻ The mesial outline is longer than the distal.

☻ The lingual outline is longer than the buccal.

- The four cusps according to the size are:

1- The mesiolingual.

2- The mesiobuccal.

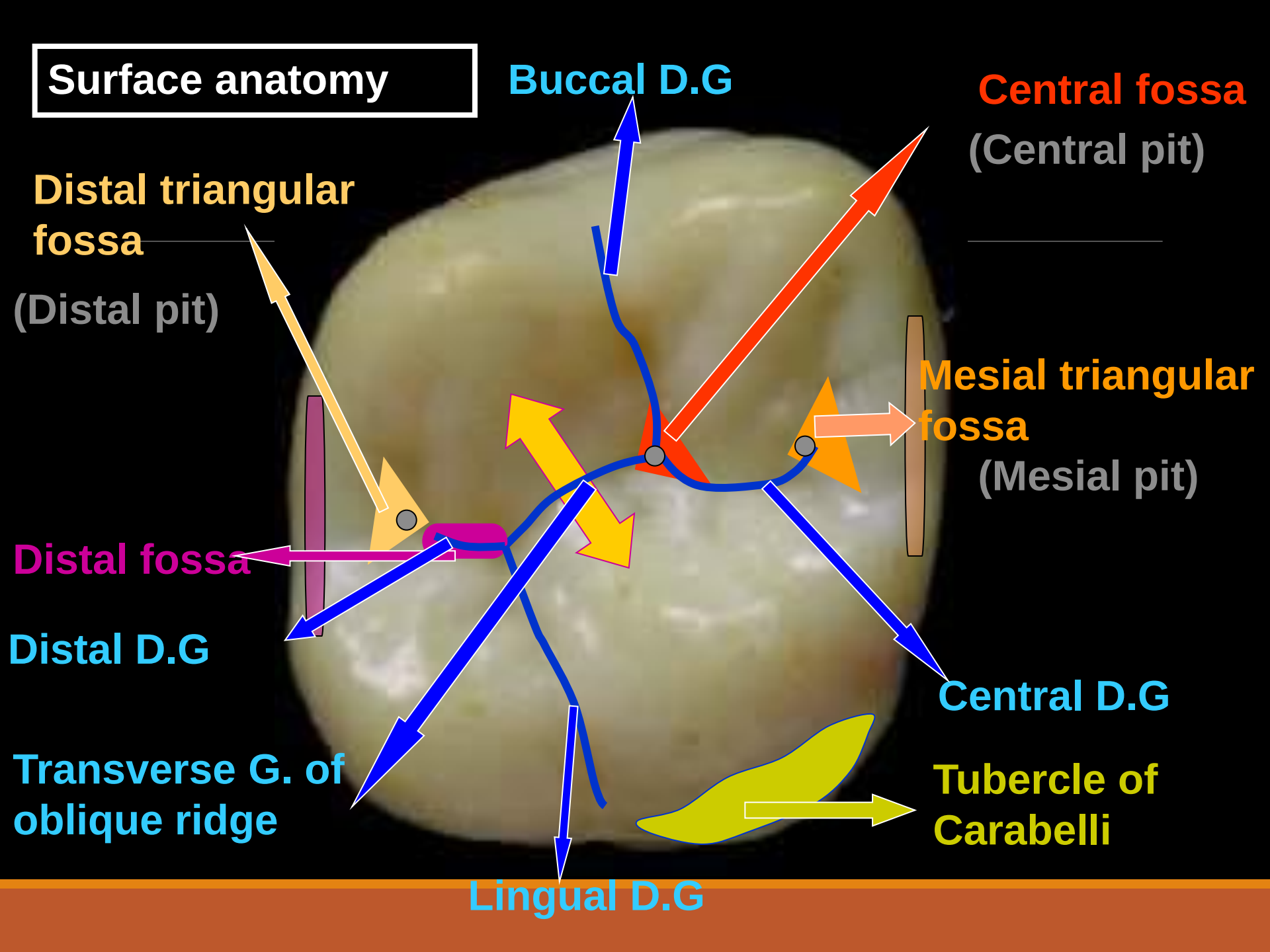
3- The distobuccal.

4- The distolingual.

☻ Tubercle of Carabelli present on the mesiolingual cusp.

- Oblique ridge connecting the mesiolingual cusp and the distobuccal cusp.

Surface anatomy



Elevations:

1-Four cusps with triangular ridges.

2-Mesial and Distal marginal ridges.

3-Oblique ridge (between the ML and DB. cusps) .

4- Cusp of Carabilli.

Depressions:

1-M ,D triangular fossae with dev. Pits (mesial &distal pits).

2-Central fossa (triangular) mesial to the oblique ridge with central dev .pit.

3-Distal fossa (elongated or linear) distal to the oblique ridge.

4-Central dev. Groove mesial to the oblique ridge

5-Buccal dev.groove.

6-Transverse G. of oblique ridge

7-Distal D.G (It connects with the lingual D.G)

8-Lingual D.G.

The pulp cavity

Bucco-lingual section

- The pulp chamber is broad with two pulp horns and smooth floor.

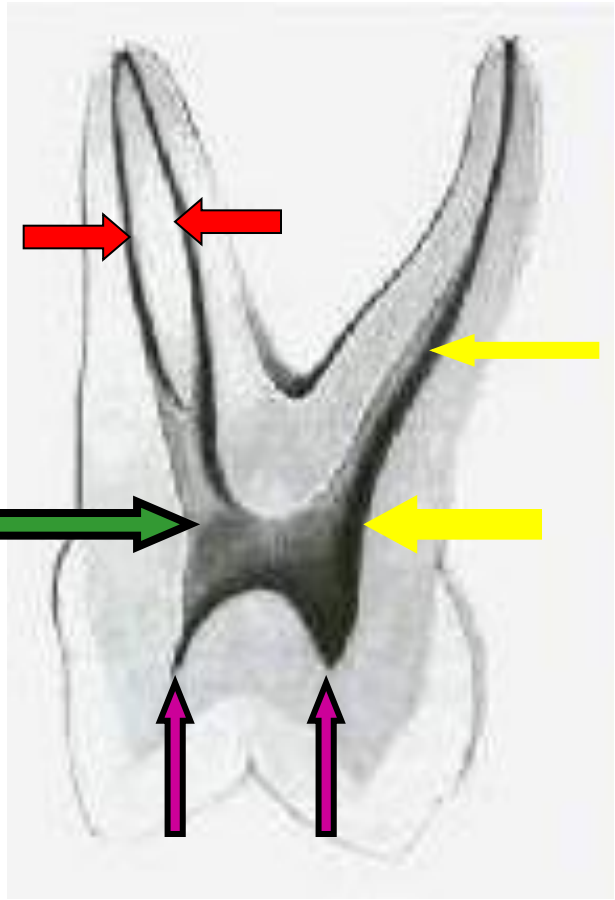
-In mesial view:

- Wide opening for the palatal and mesiobuccal root canals.

- The palatal root canal is wide and accessible ,converge gradually to apical foramen.

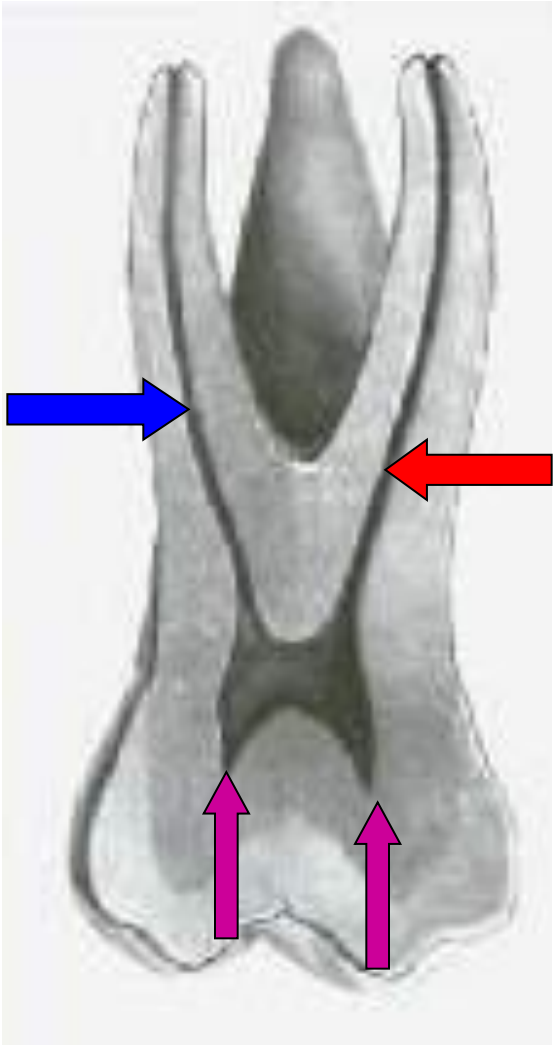
- The mesiobuccal root has two root canals with either one or two apical foramina.

The mesiobuccal root



-**In distal view;**

Wide opening to one palatal and one distobuccal root canals with two apical foramina.



Mesio-distal section

- The pulp chamber is not wide with two pulp horns.

-In buccal view:

- The mesiobuccal and distobuccal canals are narrow and tapering to the apex.

-In palatal view;

Wide palatal root canal ,wide foramin

Let's test our understanding

1) Which of the following is the largest cusp of the maxillary first molar?

A) Mesiobuccal
B) Distobuccal
C) Mesiolingual
D) Distolingual

2-How many roots does the maxillary first molar typically have?

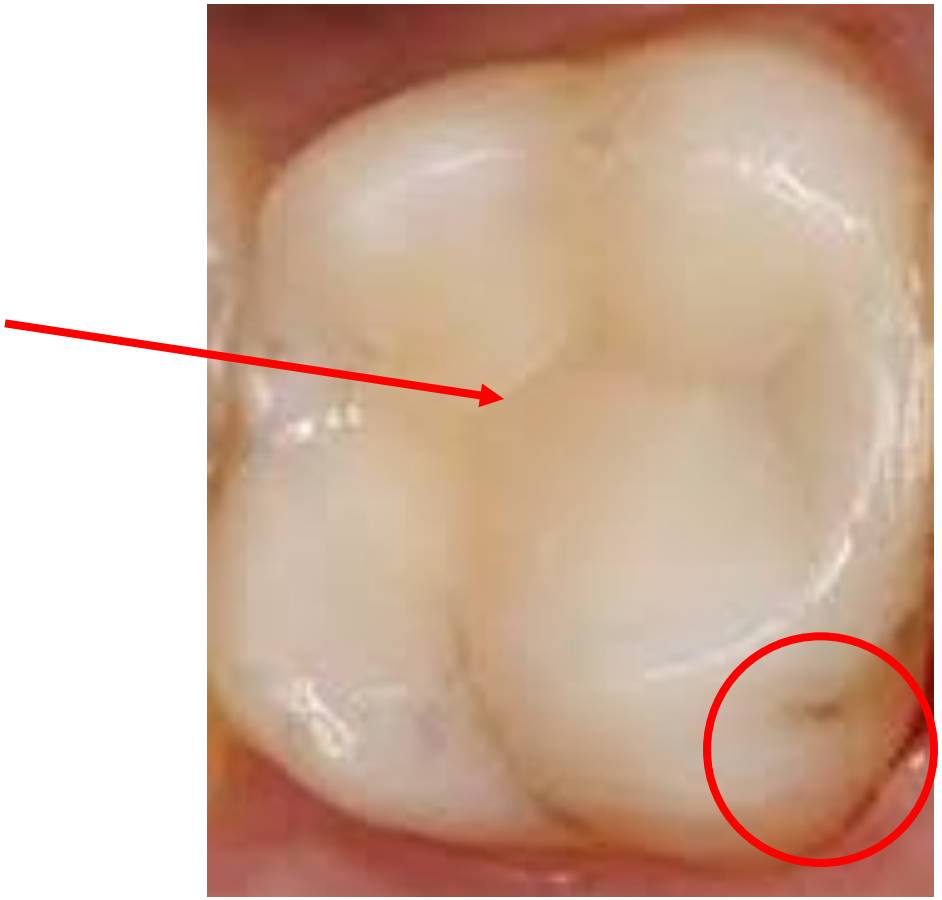
A) One
B) Two
C) Three
D) Four

3-Which of the following ridges forms the oblique ridge of the maxillary first molar?

A) Mesiobuccal and distolingual ridges
B) Mesiolingual and distobuccal ridges
C) Mesiolingual and mesiobuccal ridges
D) Distobuccal and distolingual ridges

4-Which of the following surfaces of the maxillary first molar is the widest?

A) Buccal
B) Lingual
C) Mesial
D) Distal




Thank
Thank you