



## Section I

# Dental Anatomy

1. Terminology Related to Tooth Morphology
2. The Permanent Incisors
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4. Premolars
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# Terminology Related to Tooth Morphology

## SAQs (3 Marks)

### Q 1. What are elevations on the surface of the tooth?

(Oct. 2003, May 2008, 2013, Nov. 2010, 2015)

**Ans.** Elevations on the surface of the tooth are cusps, tubercle, cingulum, lobe, ridge, and mamelons.

#### Cusp (Fig. 1.4)

- It is an elevation or mound on the crown portion of a tooth making up a divisional part of the occlusal surface.
- A cusp can also be defined as an elevation or a point or a peak on the chewing surface of a molar or a premolar and on the incisal edge of the canine.
- Cusps are named according to their location on the tooth surface.
- The number of cusps varies according to the type of the tooth. Canine has one cusp, maxillary first premolar has two cusps, mandibular second premolar may have three cusps. Maxillary first molar has four cusps and the mandibular first molar has five cusps.
- Maxillary first molar has an accessory cusp on the palatal surface of the mesiopalatal cusp called "cusp of Carabelli".
- The cusp includes the ridges that form an angle at the cusp tip.
- Each cusp has four sides or four ridges which run down from the cusp tip.
  - Mesial and distal cusp ridges or slopes.
  - Buccal and lingual cusp ridges or triangular ridges.
- The cusp ridges are named according to the direction in which they extend from the cusp tip.

#### Tubercle

- It is a smaller elevation on some portion of a crown formed by enamel only.
- It can be called a mini cusp.
- It is deviation from typical form. It is variable in size and shape. *For example:* Cusp of Carabelli on the maxillary first molar is a tubercle. On the lingual surface of some maxillary anterior teeth especially deciduous canine a tubercle may be present.

### Cingulum (Fig. 1.1)

- It is a Latin word for girdle since it encircles the cervical third of the lingual surface of the tooth mesiodistally in the form of a girdle.
- It is the lingual lobe of the anterior teeth.
- It is a bulge, a rounded **protuberance** or an elevation on the lingual surface of the anterior teeth in the cervical third of the crown.
- It makes up the bulk of the cervical third of the lingual surface of anterior teeth.

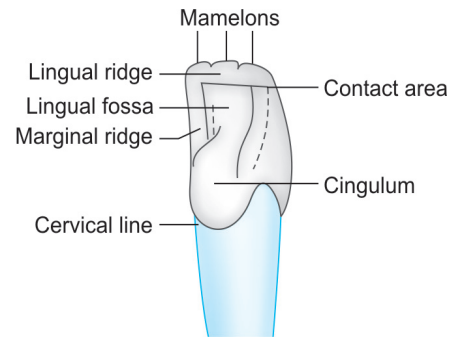


Fig. 1.1: Cingulum

### Lobe (SAQ, May 2007) (Fig. 1.2)

- It is one of the primary sections of formation in the development of the crown of the tooth.
- Development of tooth takes place by formation of 3 or 4 centres. Each centre proceeds until there is coalescence of all of them. Each of these centres is called lobe.
- In terms of evolution of dentition, tooth crowns are said to have developed from lobes or primary centres or primary anatomic divisions on teeth separated by primary grooves. Cusps and mamelons are representative of lobes.
- Cingulum represents the lingual lobe on anterior teeth and mamelons represent the labial lobes on anterior teeth.
- All normal permanent teeth develop from minimum of 4 lobes.
- Permanent anterior teeth, maxillary premolars, and mandibular first premolar develop from four lobes (3 labial, 1 lingual).
- Mandibular second premolars and mandibular first molars develop from five lobes (3 buccal, 2 lingual).
- Permanent maxillary molars develop from four lobes (2 buccal, 2 lingual).
- Exception is some maxillary third molars which develop from 3 lobes.
- **Peg-shaped** maxillary lateral incisors develop from less than 3 lobes.

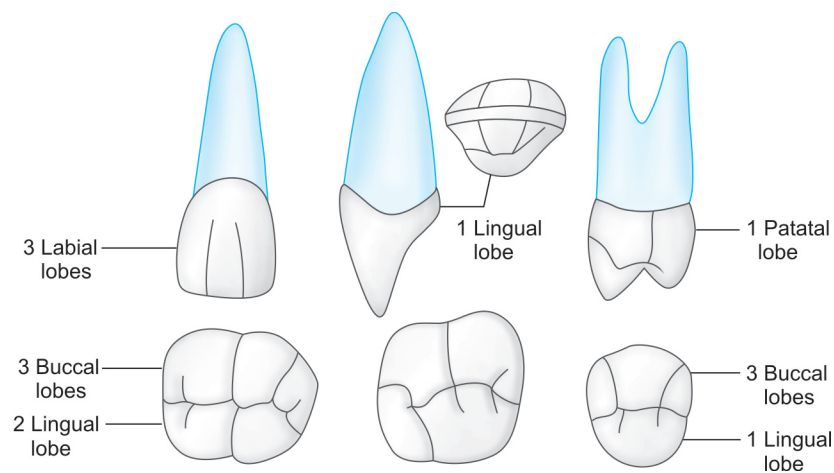


Fig. 1.2: Lobes

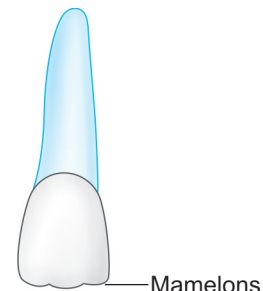
**Ridge** (SAQ, May 2009) (Fig. 1.6)

It is any linear elevation on the surface of a tooth and is named according to its location.

- **Incisal ridge** is the incisal edge of the incisor.
- **Labial ridge** is the vertical ridge on the labial surface of the canine that runs cervico-incisally from the cervical line to the cusp tip.
- **Cusp ridge:** Each cusp has four ridges. They are named by the direction in which they extend from the cusp tip.
  - Mesial and distal cusp ridges extend from the cusp tip in mesial and distal direction.
  - Buccal cusp ridge extends from the cusp tip towards the cervical line on the buccal surface of the cusp of premolars and molars.
  - Lingual cusp ridge extends on the lingual surface from the cusp tip.
- **Cervical ridge** extends mesiodistally in the cervical one-third of the facial surface of the crown. It is found on all deciduous teeth but in permanent teeth it is more prominent on mandibular second molars.
- **Marginal ridges** are rounded borders of enamel on mesial and distal borders of the lingual surface of the incisors and canines and on mesial and distal borders of the occlusal surface of premolars and molars (Fig. 1.1).
- **Triangular ridge** is the ridge from the tip of the cusp of premolars and molars towards the centre of the occlusal surface (Fig. 1.4).
- It is so named because the slopes of each side of the ridge are inclined to resemble two sides of a triangle.
  - It is named after the cusp to which it belongs. *For example:* Triangular ridge of buccal cusp, triangular ridge of lingual cusp.
  - Triangular ridge which extends from the cusp tip to the centre of the occlusal surface is same as one of the four cusp ridges (lingual cusp ridge).
  - All posterior teeth cusps have one triangular ridge each, except for the mesiolingual cusp of maxillary first molar which has two triangular ridges, mesial and distal separated by Stuart groove.
- **Transverse ridge** is the ridge that extends in buccolingual direction on the occlusal surface of the posterior teeth. It is formed by the union of triangular ridge of the buccal cusp and the lingual cusp.
- **Oblique ridge** (SAQ, 2001, May 2007, 2012) is a special type of transverse ridge, which extends buccolingually in oblique direction. It crosses the occlusal surface of the maxillary first molar of both the dentitions in an oblique direction from the mesiolingual cusp to the distobuccal cusp.
  - **Function of oblique ridge:** Central fossa of mandibular molar and oblique ridge of maxillary molar act as mortar-pestle and aid in mastication.

**Mamelons** (SAQ, 2000) (Fig. 1.3)

- Mamelons represent the lobes. Mamelons are the three rounded protuberances found on the incisal ridge of the newly erupted permanent incisor.
- They are normally worn away rather soon after eruption if the teeth are in normal occlusion.



**Fig. 1.3:** Mamelons

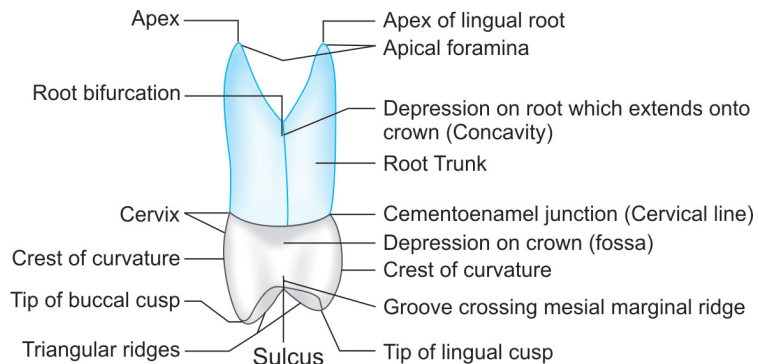
- Mamelons occasionally do not wear out when the teeth are malaligned, e.g. when there is an anterior open-bite relationship.
- Mamelons are extensions made of enamel with no dentin layer underneath and because of their thinness they appear more translucent as opposed to the rest of the clinical crown which is always more opaque than the mamelons.

**Q 2. What are depressions on the surface of the tooth?** (SAQ, Nov. 2011, 2014, 2015)

**Ans.** Depressions on the surface of the tooth are sulcus, groove, fissure, fossa, and pit.

**Sulcus** (Fig. 1.4)

- It is a broad and long depression or valley between the ridges and cusps on the occlusal surface of posterior teeth, the inclines of which meet at an angle and extends outward to the cusp tip.
- Sulcus is an elongated valley or depression on the surface of the tooth formed by the inclines of adjacent cusps or ridges, e.g. a central sulcus is a major linear depression that traverses the occlusal surface of a posterior tooth from mesial triangular fossa to distal triangular fossa.



**Fig. 1.4:** Sulcus

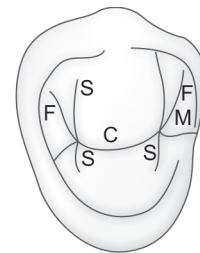
- A sulcus has a developmental groove at the junction of its inclines. (The term sulcus must not be confused with the term groove).
- It is the occlusal depression between cusps (valley) that is seen on all posterior teeth.

**Groove** (SAQ, Nov. 2004) (Fig. 1.5)

**Developmental Groove**

- It is a shallow groove or line between the primary parts of the crown or root.
- It is a shallow groove, narrow or linear depression, short or long formed during tooth development, and usually separating lobes or major portions of the tooth.

Developmental grooves  
 Central developmental groove (C)  
 Fossa (F)  
 Supplemental grooves (S)  
 Marginal ridge groove (M)



**Fig. 1.5:** Grooves

The major grooves are named according to their location.

Grooves are important escape-ways for cusps during lateral and protrusive jaw movement and for food morsels during mastication.

Buccal and lingual developmental grooves are present on the B and L surfaces of posterior teeth.

**Central groove** is present on the occlusal surface of posterior teeth.

**Supplemental Grooves**

- A supplemental groove, less distinct is also a shallow linear depression on the surface of the tooth but it is supplemental to a developmental groove and does not mark the junction of primary parts.

- They are small, irregularly placed grooves, not at the junction of lobes or major portions of a tooth, found usually on occlusal surfaces.

### Fissure

Fissure is a narrow crevice, sometimes deep, present at the depth of the developmental groove formed during development and extending inward toward the pulp from the groove.

Decay begins in a deep fissure.

### Fossa

Fossa is an irregular depression or concavity found on the surface of the tooth.

#### Lingual Fossa (Refer Fig. 1.1)

Lingual fossa is present on the incisal two-thirds of the lingual surface of the anterior teeth.

It is bounded by incisal ridge, mesial and distal marginal ridges, and cingulum.

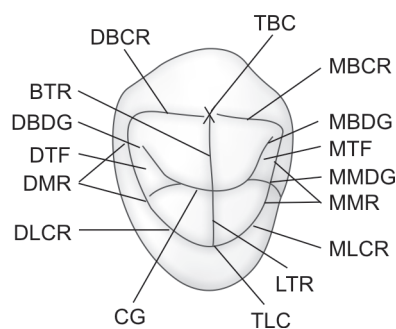
The lingual fossa of canine is divided into mesial and distal lingual fossae by the prominent lingual ridge running cervico-incisally from the cingulum to the tip of the cusp.

**Central fossa** is present on the occlusal surface of the molars and premolars. It is formed by the convergence of the ridges terminating at a central point in the bottom of the depression where there is junction of grooves (Fig. 1.7).

**Triangular fossae:** They are present on the occlusal surfaces of the posterior teeth towards the mesial and distal marginal ridges.

The mesial triangular fossa is present distal to mesial marginal ridge (MMR) and the distal triangular fossa is present mesial to distal marginal ridge (DMR) (Fig. 1.7). They are sometimes found on the lingual surfaces of maxillary incisors at the edge of the lingual fossae where the marginal ridges and cingulum meet.

**Canine fossa** is a small concavity present on the mesial surface of the crown of the maxillary first premolar just above the cervical line to accommodate the distoincisor angle of the canine or It is a mesial developmental depression on the mesial surface of the maxillary first premolar where distal rounded surface of the canine rests. It is believed to be produced due to the pressure of the distal aspect of maxillary canine as it develops earlier than the first premolar (Fig. 1.4).



**Ridges and Fossae:** Maxillary first premolar, occlusal aspect TBC. Tip of buccal cusp; MBCR, mesiobuccal cusp ridge MBDG mesiobuccal developmental groove; MTR, mesial triangle fossa, MMDG, mesial marginal development groove; MMR, mesial marginal ridge; MLCR, mesiolingual cusp ridge; LTR, lingual triangular ridge; TLC, tip of lingual cusp CR, central groove; DLCR, distolingual cusp ridge; DMR, distal marginal ridge; DTF, distal triangular fossa, DBDG, distobuccal development groove; BTR, buccal triangular ridge, DBCR, distobuccal cusp ridge.

Fig. 1.6

### Pit

**Pits** are small pinpoint depressions located at the junctions of developmental grooves or at terminals of those grooves. Pit is the deepest portion of the fossa.

Central pit is at the depth of the central fossa where developmental grooves join.

Buccal pit is on buccal surface of molars at the terminal end of buccal developmental groove.

Lingual pit is on lingual surface of molars.

Lingual pit is also present on lingual surface of maxillary lateral incisor.

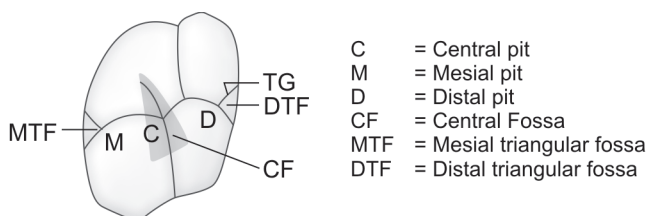


Fig. 1.7: Pits and fossae

### Q 3. What are inclined planes?

(SAQ, 2000, May 2002, 2011, Nov. 2010)

**Ans. Inclined planes** are the sloping areas found between the two cusp ridges.

Each cusp has four inclined planes. They take the name of the two cusp ridges between which they lie.

Inclined planes of buccal cusp are (Fig. 1.8):

Mesiobuccal inclined plane (MBIP)

Mesiolingual inclined plane (MLIP)

Distobuccal inclined plane (DBIP)

Distolingual inclined plane (DLIP)

**Functions:** They give stability to the posterior teeth during lateral movement of the mandible.

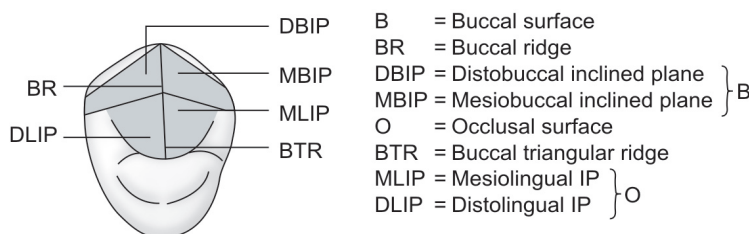


Fig. 1.8: Inclined planes

### Q 4. What is human dentition?

**Ans.**

- Dentition means a set of teeth.
- The human dentition is termed **heterodont** which means it comprises of different classes of teeth to perform different functions in the mastication process.

Human dentition has two sets of teeth—the primary set of teeth and the permanent set of teeth. Such a condition where two sets of teeth exist is known as **diphyodont**.

- **The primary teeth** are small in size, milky white in colour, 20 in number. 10 teeth in upper jaw and 10 teeth in lower jaw.

**They are also called deciduous teeth, baby teeth, lacteal teeth, milk teeth, temporary set, and first set of teeth.**

The primary teeth begin to form at about 6 weeks *in utero*.

They begin to calcify between 4–6 months *in utero*.

The crown is completed within first year after birth.



The root formation is complete one year after eruption.

They erupt between 6 months and 24 months of age.

Pattern of eruption is from anterior to posterior.

Sequence of eruption is A B D C E.

Primary dentition period is from 6 months to 6 years of age.

The first teeth to erupt are the mandibular central incisors between 6–10 months and the rest of the teeth follow.

The primary teeth are shed to be replaced by the permanent teeth. The permanent teeth that replace the primary teeth are called **succedaneous** teeth.

At around 6 years the permanent first molars erupt distal to the primary second molars. Permanent molars are called **accessional** teeth.

Primary maxillary canines are the last primary teeth to be shed.

- **The permanent teeth** are larger in size, yellowish white in colour and 32 in number. 16 teeth in each jaw.

The permanent teeth are also called **secondary teeth**.

They begin to form at birth and calcify between birth and 3 years of age except third molars which begin to calcify between 7–10 years.

The crowns of permanent teeth are completed between 4 and 8 years except third molars which are completed between 12 to 16 years.

Root is completed 3 years after eruption.

Pattern of eruption is from posterior to anterior.

Sequence of eruption in mandibular arch is 6 1 2 3 4 5 7 8 and in maxillary arch is 6 1 2 4 5 3 7 8 or 6 1 2 4 3 5 7 8.

Permanent dentition period is 12 years onward.

The first permanent tooth to erupt is the first molar at around 6 years of age.

The central incisor is the second permanent tooth to emerge in the oral cavity. Eruption time occurs quite close to that of the first molar, i.e. 6–7 years.

The mandibular permanent teeth tend to erupt before the maxillary permanent teeth.

Before the permanent central incisor can come into position, the primary CI must be exfoliated. This is brought about by the resorption of the roots of the primary CI.

Second molars erupt at around 12 years of age distal to the first molars.

The maxillary canines occasionally erupt along with the second molars, but in most instances they precede the eruption of second molars.

The third molars erupt at around 17 years or later.

#### Mixed Dentition (SAQ 2000)

- In human beings there are three periods or stages of dentition.
  - The primary dentition period from 6 months to 6 years. During this period oral motor behaviour and speech are established.
  - The mixed dentition period from 6 years to 12 years.
  - The permanent dentition period from 12 years onwards.
- During **mixed dentition** period both primary and permanent teeth are present in the oral cavity.
- It begins with the eruption of permanent first molars distal to the primary second molars.



- It is a transition stage when primary teeth are exfoliated in a sequential manner, followed by the eruption of their permanent successors.
- In the first transitional stage eruption of permanent first molars and replacement of primary incisors by the permanent incisors occurs.
- In the second transitional stage replacement of the primary molars and canines by the premolars and permanent canine occurs. It also involves the eruption of permanent second molars.
- Significant changes in occlusion occur during this stage.

**Q 5. What is clinical and anatomical crown.**

(SAQ, May 2002)

**Ans.** Each tooth features two components the crown and the root (**Fig. 1.9**).

- The crown is that portion of the tooth which is above gum line and projects into the oral cavity.
- The root is that portion of the tooth which is anchored into the socket and under the gingiva and not exposed to the oral cavity.
- **Anatomic crown** is that part of the tooth which is covered by enamel.
- **Anatomic root** is that part of the tooth which is covered by cementum.
- A **cervical line** separates anatomic crown from anatomic root. It signifies the cemento-enamel junction. This relationship does not change with age.
- Clinical crown and clinical root definition is applicable only when the tooth is in the oral cavity and at least partially erupted.
- **Clinical crown** is that part of tooth which is visible in the oral cavity. The clinical crown may be larger or smaller than the anatomical crown.

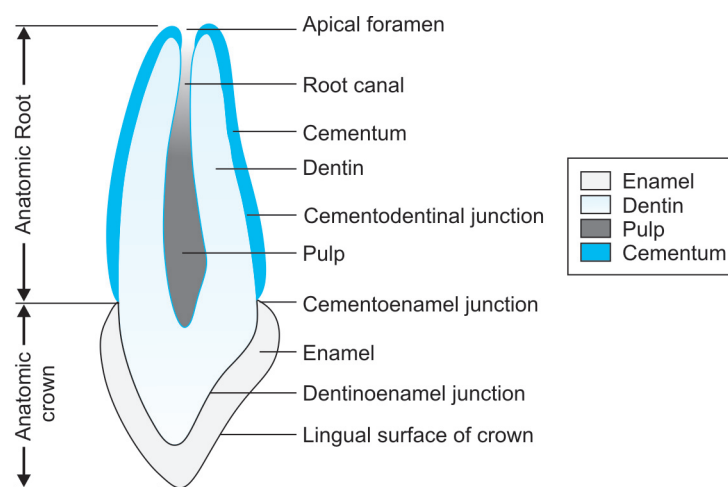
In newly erupted tooth the clinical crown is shorter than the anatomic crown.

In case of gum recession the clinical crown is longer than the anatomic crown because part of exposed root is also visible.

**Clinical root** is that part of tooth which is not visible in the oral cavity and is covered by gingiva.

This also could be either shorter than the anatomic root or longer than the anatomic root.

- The clinical crown and clinical root are separated by gingival margin (gum line).



**Fig. 1.9:** Tissues of a tooth

**Q 6. What is contact point and contact area?**

(SAQ, July 2005)

**Ans. Contact Areas/Points** (Refer Fig. 1.12)

Contact areas or points are the crests of curvatures on the proximal surfaces of the tooth crowns where the adjacent teeth contact each other in the same arch and when the teeth are in proper alignment.

Contact areas may be in the incisal third, middle third, or at the junction of incisal and middle third. They are never located more cervically than the middle of the tooth crown.

Mesial surfaces of all teeth face (approximate) the distal surfaces of the adjacent teeth except for the central incisors where the mesial surfaces approximate another mesial surface.

Every tooth in the dental arch except third molar has two contact points.

Distal surfaces of permanent third molars and distal surfaces of primary second molars until 6 years of age have no teeth distal to them.

The contact of each tooth with adjacent tooth has important functions.

1. It stabilizes the tooth within the bony socket which thereby stabilizes the dental arch.
2. It helps prevent food impaction which can lead to decay and periodontal problem.
3. It protects the interdental papilla by shunting food towards buccal and lingual areas.

**Contact areas** of teeth are at first contact points, then as the teeth rub together in function they become flattened and become contact areas.

**Q 7. What are developmental lobes?**

(May 2007)

**Ans.** Answer is same as in elevation on tooth surface.**Q 8. Define bifurcation and trifurcation.**

(SAQ, Dec. 2005)

**Ans. Furcation** (Fig. 1.4)

It is a place or area on multirooted teeth where the root trunk divides into two or three separate roots.

**Bifurcation** is two root branches from the root trunk. *For example*, maxillary first premolar and mandibular molars.

**Trifurcation** is three root branches from the root trunk. *For example*, maxillary molars.

The spaces between the roots at the furcation are called "furcation crotches".

Teeth with two roots have two furcation crotches.

Teeth with three roots have three furcation crotches.

Such crotches can be facial and lingual or mesial and distal depending on tooth type.

It may be close to CEJ or far from it.

Root concavities are also found on many root branches as well as on the furcal surfaces.

**Q 9. State human dental formula.**

(SAQ, Dec. 2005)

**Ans. Dental Formula**

- Dental formula is the number-letter designation of various teeth in a dentition.
- The number and type of teeth present in a dentition can be expressed in the form of a dental formula.
- The denomination and number of all mammalian teeth are expressed by formulae that are used to differentiate the human dentition from that of other species.
- Since the right and left halves of the dental arches are exact mirror images, the dental formula includes the teeth in both the arches but of one side of the mouth only.
- Dental formula is different for both primary and permanent dentition.

- The class of each tooth is represented by its initial letter – I for incisors, C for canine, PM for premolars, M for molars.

Each letter is followed by a horizontal line and the number of each class of tooth is placed above the line for the upper jaw and below the line for lower jaw. The formula is indicative of **one side only**.

The dental formula for primary teeth in humans

$$I \frac{2}{2} \quad C \frac{1}{1} \quad M \frac{2}{2} = 10$$

The dental formula for permanent teeth is

$$I \frac{2}{2} \quad C \frac{1}{1} \quad PM \frac{2}{2} \quad M \frac{3}{3} = 16$$

This formula should be read as incisors two maxillary and two mandibular; canines, one maxillary and one mandibular; premolars, two maxillary and two mandibular; molars, 3 maxillary and 3 mandibulars.

#### Q 10. What is eruption sequence?

##### Ans. Eruption Sequence

- The emergence of **primary teeth** takes place between the 6th and 13th months of postnatal life.
- The sequence of eruption of primary teeth in each jaw is central incisor A, lateral incisor B, 1st molar D, canine C, 2nd molar E.
- The lateral incisors, first molars and canines tend to erupt earlier in maxilla than in mandible.
- The eruption sequence of primary dentition can be represented as follows:

$$\begin{array}{cccc} AB & D & C & E \\ \hline A & B & D & CE \end{array}$$

- In general, the teeth erupt earlier in females than in males.
- The mandibular **permanent teeth** tend to erupt before their maxillary counterparts.
- The sequence of eruption of permanent dentition is more variable than that of the primary dentition.

There is a significant difference in the sequence of eruption between the two arches.

- Most common sequence of eruption in the maxillary arch is  
6-1-2-4-3-5-7-8 or  
6-1-2-4-5-3-7-8
- Most common sequence of eruption in the mandibular arch is  
6-1-2-3-4-5-7-8
- Mandibular canines usually erupt before the mandibular premolars.
- Maxillary canines erupt after the eruption of maxillary premolars, due to which very often they erupt labially or palatally because of loss of space due to mesial shift of erupted premolars.
- Usually the first permanent teeth to erupt are the first molars around 6 years of age. They are thus called **6 years** molars also.
- The mandibular central incisors erupt simultaneously or immediately after the first molars at around 6–7 years.

- Maxillary central incisors erupt next at around 7–8 years.
- Maxillary first premolars and mandibular canines follow the maxillary lateral incisors at around 10 years.
- Second premolars follow the next year and then the maxillary canines.
- The next are the second molars around 12 years of age. They are also called as **12 years molar**.
- The third molars erupt between 17–21 years. They may be impacted or even absent.

#### Q 11. Explain nomenclature system.

**Ans. Nomenclature System/Tooth Numbering System/Notation System (NS)**

- Tooth numbering system has been developed in order to have a standard way of referring to particular teeth.
- When identifying a specific tooth one has to list the dentition, the dental arch, the quadrant and the tooth name. Listing all this information in words is cumbersome and time-consuming.
- The numbering system acts like a dental 'short hand' used in the clinic to simplify tooth identification providing a standard and easy way of communication among dental professionals, students and care providers.
- It also gives a convenient method of record keeping in dental practice.
- Although there have been many different numbering systems, three systems are in common use.
- It is necessary to be familiar with all the three notation systems (NS) so that communication between the dental offices is efficient. However, it is important to stick to one NS in a dental practice so as to avoid confusion. Also it is important to specify which system is used.

The three numbering systems in common use are:

1. Palmer notation or Zsigmondy's NS/quadrant system/grid system.
2. FDI International NS is Federation Dentaire Internationale.
3. Universal NS.

**Palmer notation** is the oldest method in use and most popular system.

- In palmer NS the symbol for the quadrant is derived from an imaginary cross, with the horizontal bar placed between the upper and lower teeth and the vertical bar running between the right and left central incisors (quadrants).
- Each quadrant is assigned a specific symbol.

UR	UL	UR = Upper right
LR	LL	UL = Upper left
		LL = Lower left
		LR = Lower right

- Permanent teeth are numbered 1 to 8 in each quadrant from midline.
- Deciduous teeth are lettered A to E in each quadrant from the midline where A represents central incisor and E represents second molar.
- Only one digit is used.

$\frac{6}{\quad}$  is maxillary right first molar.

$\frac{\quad}{1}$  is mandibular right central incisor.

- In this notation: 1 represents the central incisor and 8 represents the third molar.
- Palmer NS is not accepted by computer.  
In this system verbal communication is difficult.

***Federation Dentaire Internationale (FDI) NS: (SAQ, June 2004, May 2009)***

- In FDI system, the quadrants are represented by numbers and no letters of alphabet are used.
- For permanent and deciduous dentition the quadrants are numbered as:
  - Permanent dentition  
UR = 1, UL = 2, LL = 3, LR = 4
  - Deciduous dentition  
UR = 5, UL = 6, LL = 7, LR = 8
- In this system permanent teeth are numbered 1 to 8 starting from midline and deciduous teeth are numbered 1 to 5 from the midline.
- This system uses two digits.  
The **first digit** always denotes the **dentition, arch, and side**.  
The **second digit** denotes the **tooth number**: For example, 51 symbolizes deciduous maxillary right central incisor and 26 symbolizes permanent maxillary left first molar.
- The notation is read as five one and two six.
- FDI NS is accepted by WHO and by computer.
- In this system verbal communication is easier.

***Universal NS:***

- In permanent dentition the teeth are numbered 1 to 32 starting with maxillary right third molar.
- **In UR** quadrant the teeth are numbered 1 to 8  
where 1 represents maxillary right third molar, and  
8 represents maxillary right central incisor.
- **In UL** quadrant the teeth are numbered 9 to 16,  
where 9 represents maxillary left central incisor, and  
16 represents maxillary left third molar.
- **In LL** quadrant the teeth are numbered 17 to 24,  
where 17 represents mandibular left third molar, and  
24 represents mandibular left central incisor.
- **In LR** quadrant the teeth are numbered 25 to 32,  
where 25 represents mandibular right central incisor, and  
32 represents mandibular right third molar.
- In **deciduous dentition** the teeth are lettered A to T starting with maxillary right second molar.
- **In UR** quadrant the teeth are lettered A to E,  
where A represents maxillary right second molar, and  
E represents maxillary right central incisor.
- **In UL** quadrant the teeth are lettered F to J,  
where F represents maxillary left central incisor, and  
J represents maxillary left second molar.

- In **LL** quadrant the teeth are lettered K to O,  
where K represents mandibular left second molar, and  
O represents mandibular left central incisor.
- In **LR** quadrant the teeth are lettered P to T,  
where P represents mandibular right central incisor, and  
T represents mandibular right second molar.

#### NUMBERING SYSTEMS

##### PERMANENT DENTITION/MAXILLA/UPPER JAW/MAXILLARY ARCH

PERMANENT DENTITION/MAXILLA/UPPER JAW/MAXILLARY ARCH																		
RIGHT										LEFT								
Quadrant 1										Quadrant 2								
U	Universal NS	1	2	3	4	5	6	7	8		9	10	11	12	13	14	15	16
F	FDI NS	18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
P	Palmer	8	7	6	5	4	3	2	1		1	2	3	4	5	6	7	8
Class of Teeth		M	M	M	PM	PM	C	LI	CI	Mid-line	← Mesial				Distal →			
P	Palmer	8	7	6	5	4	3	2	1		1	2	3	4	5	6	7	8
F	FDI NS	48	47	46	45	44	43	42	41		31	32	33	34	35	36	37	38
U	Universal	32	31	30	29	28	27	26	25		24	23	22	21	20	19	18	17
Quadrant 4										Quadrant 3								
Mandible/lower jaw/mandibular arch																		
e.g. Maxillary Left Central incisor																		
		P		FDI		U												
		1		21		9												
DECIDUOUS DENTITION/SET																		
Maxillary Teeth																		
Universal		A	B	C	D	E		F	G	H	I	J						
FDI NS		55	54	53	52	51		61	62	63	64	65						
Palmer		E	D	C	B	A		A	B	C	D	E						
Class of Teeth		M	M	C	LI	CI		CI	LI	C	M	M						
Palmer		E	D	C	B	A		A	B	C	D	E						
FDI		85	84	83	82	81		71	72	73	74	75						
Universal		T	S	R	Q	P		O	N	M	L	K						
RIGHT										LEFT								
Mandibular Teeth																		

##### DECIDUOUS DENTITION/SET

Maxillary Teeth										
Universal	A	B	C	D	E	F	G	H	I	J
FDI NS	55	54	53	52	51	61	62	63	64	65
Palmer	E	D	C	B	A	A	B	C	D	E
Class of Teeth	M	M	C	LI	CI	CI	LI	C	M	M
Palmer	E	D	C	B	A	A	B	C	D	E
FDI	85	84	83	82	81	71	72	73	74	75
Universal	T	S	R	Q	P	O	N	M	L	K
RIGHT					LEFT					
Mandibular Teeth										

#### Q 12. What are the functions of teeth?

Ans. **Functions of Teeth** (May 2009, Nov. 2010)

- The primary function of teeth is to prepare food for swallowing and to facilitate digestion.
- Different types of teeth with their respective forms are adapted to incise, shear and grind food.

- The teeth with their proper form and alignment protect the supporting periodontal tissues against trauma during mastication, facilitate jaw movement, speech, and enhance esthetic appearance of face by supporting lips and cheeks.
- In deciduous dentition the primary teeth maintain space in the dental arch for the development and eruption of permanent teeth.
- They function in the development of speech.
- Ability to use teeth for pronunciation is acquired entirely with the aid of primary dentition. Early and accidental loss of primary anterior teeth may lead to difficulty in pronouncing the sounds f, v, s, z, th.

### Q 13. What are line angles and point angles?

(SAQ, Nov. 2015)

#### Ans. Line Angles

A line angle is formed by the junction of two surfaces and derives its name from the combination of the two surfaces that join (Fig. 1.10).

The 'al' of the first term is changed to 'o'. For example, on the anterior tooth the junction of the mesial and labial surface is termed "mesiolabial".

#### Line angles of anterior teeth are 6

1. Mesiolabial
2. Mesiolingual
3. Distolabial
4. Distolingual
5. Labioincisal
6. Linguoincisor

Because the mesioincisal and distoincisor angles are rounded they are usually considered nonexistent and spoken as mesial incisor and distal incisor angle.

#### Line angles of posterior teeth are 8

- Mesiobuccal
- Mesiolingual
- Mesioocclusal
- Distobuccal
- Distolingual
- Distoocclusal
- Buccoocclusal
- Linguoocclusal

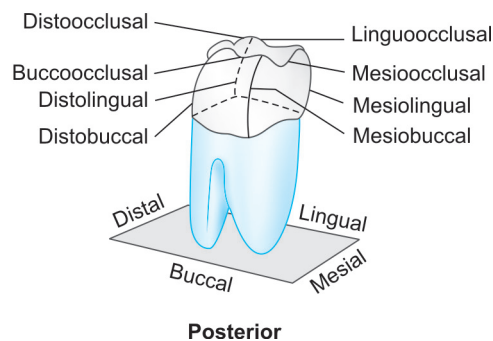
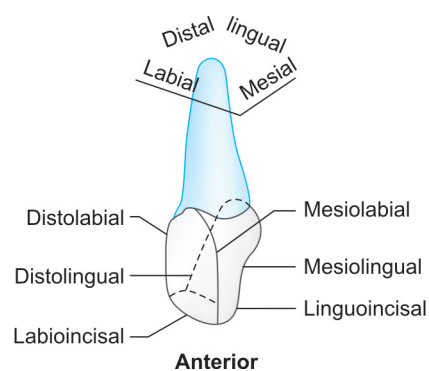


Fig. 1.10: Line angles

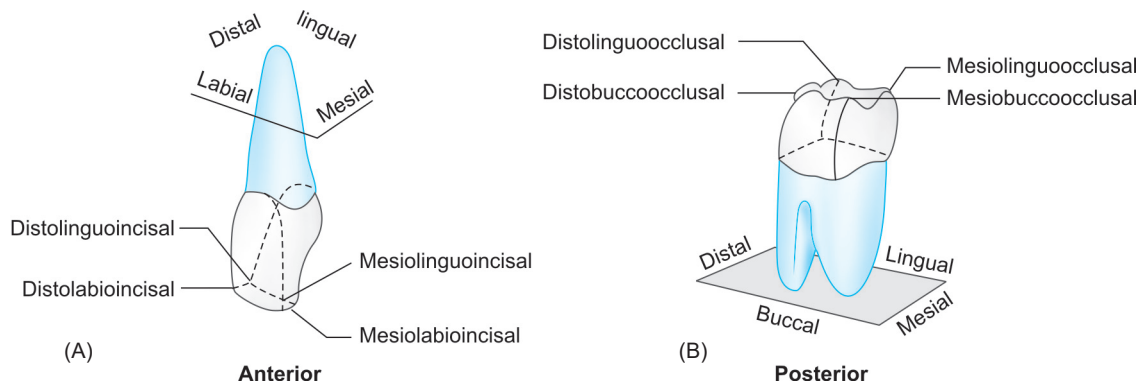
#### Point Angles

A point angle is formed by the junction of three surfaces. A point angle also derives its name from the combination of three surfaces (Figs 1.11A and B).



Point angles of both anterior and posterior teeth are four.

<i>Anterior teeth [4]</i>	<i>Posterior teeth [4]</i>
1. Mesiolabioincisal	Mesiobuccooocclusal
2. Mesiolinguoincisal	Mesiolinguooocclusal
3. Distolabioincisal	Distobuccooocclusal
4. Distolinguoincisal	Distolinguooocclusal



**Figs 1.11A and B:** Point angles

#### Q 14. What are embrasures?

(Oct. 2002, June 2006, May 2011, 2013)

##### Ans. Embrasures

When the teeth in the same arch contact each other, there are four continuous spaces surrounding the contact area, these triangular shaped spaces or V-shaped spillway spaces adjacent to the contact area are called **embrasures** (Figs 1.12A and B).

They are named according to their location, which depends on the aspect from which the teeth are viewed.

When viewing the teeth from facial or lingual aspect, the two embrasures are incisal/occlusal and gingival/cervical.

The cervical embrasure corresponds to interproximal space and is normally larger in area than the incisal embrasure.

When viewing the teeth from the incisal/occlusal aspect the two embrasures which are visible are the facial and palatal embrasure.

Ideally if an imaginary line is drawn to bisect the embrasure space, the two portions would be symmetrical.

Embrasures have two physiologic purposes.

- To serve as spillway for food during mastication.
- To serve as an integral part of the self-cleansing process of the teeth.

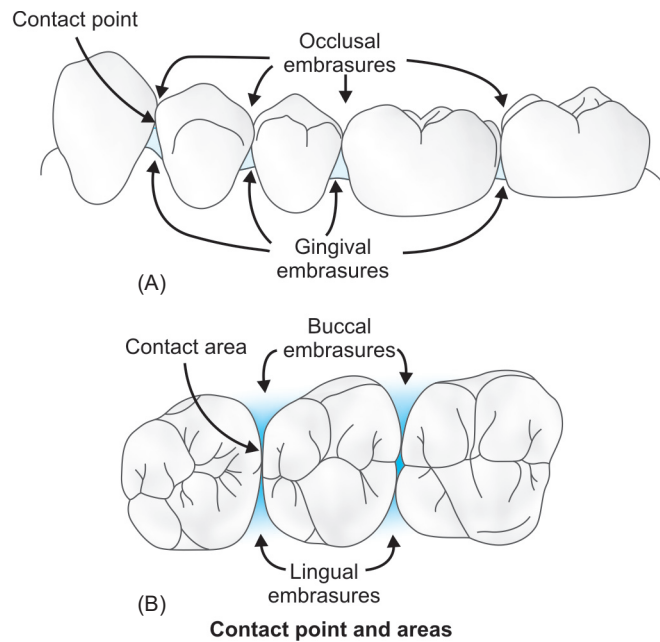
Some general rules regarding normal embrasure form:

- From facial and lingual aspect

Incisal embrasure increases in size from anterior to posterior.

Cervical embrasure decreases in size from anterior to posterior.

- From incisal aspect, the labial and lingual embrasures are nearly equal in size in anterior teeth.



**Figs 1.12A and B:** Embrasures

3. From occlusal aspect, the lingual embrasure is normally larger than the buccal embrasure in the posterior teeth.
4. One side of the embrasure has a certain contour, the other side of the embrasure will normally have a similar contour.

It should now be easy to recognize the interrelationship between contact areas and embrasure form.

*For example* as the contact area becomes more cervically placed from anterior to posterior, the relative size of the incisal embrasure increases in size.

## MULTIPLE CHOICE QUESTIONS (MCQs)

1. The information written about both maxillary and mandibular teeth of one side only is known as:
  - a. Dental formula
  - b. Palmer notation
  - c. FDI system
  - d. Universal system
2. A trait that distinguishes the characteristics between the same class of teeth is:
  - a. A set trait
  - b. Arch trait
  - c. Class trait
  - d. Type trait
3. A trait that distinguishes the features between the maxillary and the mandibular teeth is the
  - a. Class trait
  - b. Type trait
  - c. Arch trait
  - d. Dentition trait
4. A trait that distinguishes the features between the permanent and the primary teeth is the
  - a. Set trait
  - b. Dentition trait
  - c. Class trait
  - d. a and b
5. The part of a tooth which has enamel as the outer surface is
  - a. Anatomic crown
  - b. Anatomic root
  - c. Clinical crown
  - d. Clinical root
6. The part of a tooth which has cementum as the outer surface is
  - a. Clinical crown
  - b. Clinical root
  - c. Anatomic crown
  - d. Anatomic root
7. The part of a tooth that is visible in the oral cavity is
  - a. Anatomic crown
  - b. Anatomic root
  - c. Clinical crown
  - d. Clinical root
8. A line that separates the anatomic crown from the anatomic root is the
  - a. Gum line
  - b. Cervical line
  - c. Cemento-enamel junction
  - d. Both b and c
9. The relationship between the following does not change over a patient's life time
  - a. Clinical crown and anatomic crown
  - b. Clinical root and anatomic root
  - c. Anatomic crown and anatomic root
  - d. Clinical crown and clinical root
10. The hard, white, shiny, protective outer covering of the anatomic crown is
  - a. Dentin
  - b. Cementum
  - c. Enamel
  - d. Pulp
11. The dull yellow external surface of the anatomic root is
  - a. Enamel
  - b. Dentin
  - c. Pulp
  - d. Cementum
12. The inner surface of cementum lining the root is
  - a. The cemento-enamel junction
  - b. The cementodentinal junction
  - c. The dentino-enamel junction
  - d. The dentinopulpal junction
13. The surface of the tooth which is next to face is
  - a. The labial surface
  - b. The buccal surface
  - c. The facial surface
  - d. All of the above
14. The surface of the tooth which is next to the adjacent tooth is the
  - a. Proximal surface
  - b. Mesial surface
  - c. Distal surface
  - d. All of the above

1-a, 2-d, 3-c, 4-d, 5-a, 6-d, 7-c, 8-d, 9-c, 10-c, 11-d, 12-b, 13-d, 14-d

15. An elevation on the chewing surface of a molar or a premolar and on the incisal edge of the canine is known as  
a. Tubercle      b. Cingulum  
c. Cusp      d. Ridge
16. A longitudinal convexity or any linear elevation on the surface of a tooth is known as  
a. A groove      b. A ridge  
c. Tubercle      d. Cingulum
17. A rounded protuberance in the cervical third of the lingual surface of the anterior teeth is  
a. Cusp      b. Tubercle  
c. Ridge      d. Cingulum
18. The numbering system in which the permanent teeth in each quadrant are numbered 1 to 8 and the deciduous teeth are numbered 1 to 5 or A to E is  
a. Palmer notation  
b. FDI system  
c. Universal system  
d. Both a and b
19. The numbering system which uses two digits where the first digit denotes arch, dentition and side and the second digit denotes the tooth number is  
a. Universal NS  
b. Zsigmondy's NS  
c. FDI NS  
d. All of the above.
20. The primary centres of tooth development or primary anatomic divisions of tooth are known as  
a. Lobes      b. Ridges  
c. Pits      d. Grooves
21. The sloping areas found between the two cusp ridges are known as inclined planes, the number of inclined planes for each cusp are  
a. 2      b. 6  
c. 4      d. 8
22. A shallow, narrow, linear depression formed during tooth development and separating lobes is known as  
a. Fissure  
b. Developmental groove  
c. Supplemental groove  
d. Sulcus
23. An irregular depression or concavity found on the surface of the tooth, bounded by ridges is known as  
a. Sulcus  
b. Groove  
c. Fossa  
d. None of the above
24. The central fossa is found on the following surface of the tooth  
a. Lingual surface of the anterior teeth  
b. Occlusal surface of all the posterior teeth  
c. Occlusal surface of all molars  
d. Occlusal surface of y-shaped mandibular second premolar  
e. Both c and d
25. The convex bulge or curvature on the crown of a tooth, that determines the direction of food as it is pushed cervically over the tooth surface during mastication is the  
a. Height of contour  
b. Crest of curvature  
c. Both a and b  
d. None of the above
26. The height of contour on the facial surface of all the crowns of tooth (as seen from mesial and dental aspect) is in the  
a. Incisal third      b. Middle third  
c. Cervical third      d. All of the above
27. The crest of curvature on the lingual surface of all the anterior teeth is in the  
a. Incisal third  
b. Middle third  
c. Entire lingual surface  
d. Cervical third

15-c, 16-b, 17-d, 18-d, 19-c, 20-a, 21-c, 22-b, 23-c, 24-e, 25-c, 26-c, 27-d

- 28. The crest of curvature on the lingual/palatal surface of the posterior teeth is in the**  
a. Middle third b. Incisal third  
c. Cervical third d. Entire surface
- 29. Crest of curvature on the proximal surfaces of the crowns of the teeth, where the adjacent teeth in the same arch touch each other are known as**  
a. Contact point b. Contact area  
c. Both a and b d. None of the above
- 30. Contact areas are located in**  
a. Incisal third  
b. Middle third  
c. In the cervical third  
d. Both a and b
- 31. The continuous triangular spaces surrounding the contact area between the two adjacent teeth in contact with each other is known as**  
a. Incisal embrasure  
b. Cervical embrasure  
c. Labial embrasure  
d. Lingual embrasure  
e. All of the above
- 32. The relative position of contact area in the facial view of teeth is demonstrated**  
a. Cervicoocclusally  
b. Buccolingually  
c. Both of the above  
d. None of the above
- 33. In teeth, embrasures are**  
a. Wider facially than lingually  
b. Wider lingually than facially  
c. Same facially and lingually  
d. None of the above
- 34. Although there are two dentitions, the primary and the secondary, the 'dentition periods' that occur during a patients lifetime are**  
a. One b. Two  
c. Three d. Four
- 35. Teeth may have one or more roots, but all the roots of both the dentitions have common traits which are**  
a. Widest at CEJ and taper towards the apex  
b. Taper facial to lingual  
c. Bulbous uniformly  
d. Both a and b
- 36. The occlusal view demonstrates the relative position of contact area**  
a. Faciolingually  
b. Cervicoocclusally  
c. Both of the above  
d. None of the above
- 37. The only tooth other than maxillary third molar which has only one antagonist is**  
a. Mandibular CI  
b. Mandibular LI  
c. Mandibular second PM  
d. Mandibular third molar
- 38. The largest embrasure in the dental arch is**  
a. Between maxillary canine and maxillary first PM  
b. Between maxillary LI and maxillary canine  
c. Between maxillary CI and maxillary LI  
d. None of the above.
- 39. The height of epithelial attachment is dependent on**  
a. Height of contact area  
b. Curvature of cervical line  
c. Height of alveolar bone  
d. All of the above
- 40. Midline foramina of incisive canal is called**  
a. Foramen of Scarpa  
b. Foramen of Larschak  
c. Foramen of Stenson  
d. Foramen rotundum.

41. The number of line angles in the crowns of mandibular first molar are  
a. 4                      b. 6  
c. 8                      d. 10
42. Human dentition has different classes of teeth incisors, canines, premolars, and molars such a condition where more than one type of teeth are present is called  
a. Homodont      b. Heterodont  
c. Haplodont      d. None of the above
43. The last succedaneous tooth to erupt is  
a. Maxillary canine  
b. Maxillary first premolar  
c. Mandibular canine  
d. Mandibular first premolar
44. The palatal cusp of upper first premolar develop from  
a. One lingual lobe  
b. Lingual lobe and distal lobe  
c. Lingual lobe and mesial lobe  
d. Distal and mesial lobe
45. Which of the premolars develop from five lobes?  
a. Upper first premolar  
b. Upper second premolar  
c. Lower first premolar  
d. Lower second premolar
46. Main function of proximal contact area  
a. Stabilizes the dental arch  
b. Helps prevent food impaction  
c. Distribution of occlusal forces  
d. All of the above
47. The line angle which does not exist in any tooth  
a. Mesiobuccal  
b. Mesiolingual  
c. Mesiodistal  
d. Distolingual
48. The mesial contact is at the junction of incisal and middle third and distal contact is at the centre of middle third in  
a. Maxillary central and lateral incisor  
b. Maxillary lateral incisor and canine  
c. Maxillary canine and first premolar  
d. Maxillary first and second premolar
49. In maxillary arch posterior embrasures are larger on the lingual side in all teeth except between  
a. First and second premolar  
b. Second premolar and first molar  
c. First premolar and canine  
d. First and second molar
50. In posterior teeth, wider lingual embrasure and shallow occlusal embrasure are due to the position of contact  
a. Buccoocclusally  
b. Buccogingivally  
c. Linguogingivally  
d. Linguoocclusally
51. The largest occlusal embrasure is found between maxillary  
a. Second and third molars  
b. Canine and first premolar  
c. First premolar and second premolar  
d. First and second molar
52. The widest incisal embrasure is found between  
a. Maxillary central incisors  
b. Maxillary central and lateral incisor  
c. Maxillary lateral incisor and canine  
d. Mandibular central incisors
53. Which of the following does not contribute to arch stability  
a. Embrasure  
b. Contact areas  
c. Root form  
d. Periodontal fibres

41-c, 42-b, 43-a, 44-a, 45-d, 46-d, 47-c, 48-b, 49-b, 50-a, 51-b, 52-c, 53-a

54. The part of the tooth outlined by its developmental grooves is called as  
a. Fissure                      b. Lobes  
c. Sulci                        d. Cusps
55. In the intercuspal position, which of the following anterior teeth contact one anterior and one posterior antagonists  
a. Maxillary canine  
b. Mandibular canine  
c. Maxillary lateral incisor  
d. Mandibular lateral incisor
56. Wilson curve in mandibular arch is  
a. Concave  
b. Convex  
c. Concave-convex  
d. Convexo-concave
57. Mesial contact area is found in incisal third of the crown surface of  
a. Maxillary central incisor  
b. Mandibular central incisor  
c. Mandibular lateral incisor  
d. Mandibular canine  
e. All of the above
58. Contact area present at the junction of incisal and middle third of the crown surface are at  
a. Distal surface of maxillary CI  
b. Mesial surface of maxillary LI  
c. Mesial surface of maxillary canine  
d. Distal surface of mandibular canine  
e. All of the above
59. The distal contact point is in the middle of the middle third of the distal surface of the crown of  
a. Maxillary LI    b. Maxillary canine  
c. Both a and b    d. None of the above
60. What is the term used for the division of the root into 3 segments  
a. Furcation            b. Bifurcation  
c. Trifurcation        d. All of the above
61. The height of the clinical root is determined by the position of the  
a. CEJ                      b. Gingival margin  
c. Alveolar bone    d. Both a and b
62. All are hard tissues of tooth except  
a. Pulp                      b. Cementum  
c. Dentin                  d. Enamel
63. Tissues of tooth which develop from mesodermal structure are  
a. Enamel                  b. Dentin  
c. Pulp                      d. Both b and c
64. The fibres which attach or anchor the teeth to the alveolus are  
a. PDL fibres            b. Gingival fibres  
c. Both a and b        d. None of the above
65. The opening present at the apex of the tooth is termed  
a. Apical foramen  
b. Accessory foramen  
c. Both a and b  
d. None of the above
66. Compared to incisal embrasure between maxillary central and lateral incisor, the incisal embrasure between the maxillary central incisors is  
a. Larger                    b. Smaller  
c. The same size    d. None of the above
67. The first succedaneous tooth to erupt is a  
a. Maxillary central incisor  
b. Maxillary lateral incisor  
c. Mandibular central incisor  
d. Mandibular first molar
68. The following groove separates cusp ridges from marginal ridges  
a. Supplemental  
b. Developmental  
c. Mesiomarginal developmental  
d. Marginal ridge developmental

54-b, 55-a, 56-a, 57-e, 58-e, 59-c, 60-c, 61-b, 62-a, 63-d, 64-a, 65-a, 66-b, 67-c, 68-b



- 69. Mamelons are present on**  
a. Newly erupted deciduous incisors  
b. Newly erupted permanent incisors  
c. Newly erupted canines  
d. All newly erupted anteriors
- 70. In reptiles the mandible consists of**  
a. Dentary                      b. Quadrate  
c. Articulare                d. All of the above
- 71. Out of the three bones found in reptile mandible the bone retained in human mandible is**  
a. Dentary                      b. Quadrate  
c. Articulare                d. None of the above
- 72. The proper contact relation between neighbouring teeth in each arch is important**  
a. To prevent food lodgement  
b. Stabilize the dental arches  
c. Protect interdental papilla  
d. All the above
- 73. The last molars are prevented from drifting distally**  
a. By the angulation of their occlusal surface with their roots  
b. By the angle of the direction of the occlusal forces in their favour  
c. Both a and b  
d. None of the above
- 74. The interproximal space is affected by or depends on**  
a. Form of teeth  
b. Relative position of contact areas  
c. Both a and b  
d. None of the above
- 75. All aspects of each tooth crown except the incisal or occlusal aspect may be outlined schematically within geometric figures**  
a. A triangle                      b. Trapezoid  
c. Rhomboid                      d. All of the above
- 76. The crown and root are separated by**  
a. Cervical line  
b. Dentinoenamel junction  
c. Cementoenamel junction  
d. Both a and c
- 77. Occlusal and incisal surface are together termed as**  
a. Proximal surfaces  
b. Facial surfaces  
c. Masticatory surfaces  
d. Both a and b
- 78. The angle formed by junction of 3 surfaces is**  
a. Point angle                      b. Line angle  
c. None                              d. Both
- 79. Fossa is**  
a. A shallow depression seen between the primary parts of a tooth  
b. An irregular depression on the surface of a tooth  
c. It is a linear depression separating the cusps  
d. All the above
- 80. According to the Universal notation system 'E' denotes**  
a. Primary second molar  
b. Primary right central incisor  
c. Primary first molar  
d. Primary left central incisor
- 81. In the universal notation system, maxillary permanent right central incisor and maxillary left canine are designated as**  
a. 1 and 3                      b. Number 8 and 11  
c. 11 and 23                      d. 9 and 12
- 82. The numbering system accepted by World Health Organisation is**  
a. The universal notation system  
b. The palmer notation  
c. The FDI system  
d. All the above

69-b, 70-d, 71-a, 72-d, 73-c, 74-c, 75-d, 76-d, 77-c, 78-a, 79-b, 80-b, 81-b, 82-c

- 83. The numbering system acceptable to computer language is**  
a. FDI  
b. Palmer notation  
c. The universal system  
d. Both a and c
- 84. A two digit system for numbering is**  
a. FDI  
b. The universal system  
c. None of the above  
d. Palmer notation
- 85. According to FDI system, the permanent maxillary right first molar and the primary maxillary left canine are designated as**  
a. 16 and 63      b. 6 and c  
c. 46 and 73      d. 3 and H
- 86. Calcification and eruption of both deciduous and permanent teeth was given by**  
a. Nolla  
b. Anderson  
c. Logan and Kronfeld  
d. Mccall and Schour
- 87. The number of centers for formation of each tooth are**  
a. One      b. Two  
c. Three      d. Four or more
- 88. Mesial surface of one tooth contacts the distal surface of its neighbour except for the distal surfaces of**  
a. Distal surfaces of third molars of permanent teeth  
b. Distal surfaces of second molars of deciduous teeth  
c. Both a and b  
d. None of the above
- 89. The teeth which have their mesial surfaces contacting each other are**  
a. Maxillary central incisors  
b. Mandibular central incisors  
c. Both are correct  
d. Both are wrong
- 90. Cusps and mamelons represent**  
a. Tubercule      b. Ridge  
c. Lobe      d. None
- 91. The longest uneven side of each of the trapezoid outlines of the facial and lingual aspects of all teeth forms the**  
a. Occlusal line      b. Cervical line  
c. Buccal line      d. Lingual line
- 92. The longest uneven side of the trapezoid outline of the mesial and distal aspect of maxillary posterior represents the**  
a. Occlusal line  
b. Buccal line  
c. Lingual line  
d. Base of the crown (cervical line)
- 93. Cervical portion of a posterior tooth is smaller than that of occlusal portion when viewed from**  
a. Mesial or distal  
b. Buccal or lingual aspect  
c. Both  
d. None of the above
- 94. When the posterior tooth is viewed from mesial or distal aspect the occlusal portion is**  
a. Smaller than cervical  
b. Larger than cervical  
c. Equal to cervical  
d. None of the above
- 95. With increasing age**  
a. Anatomical crown > clinical crown  
b. Anatomical crown < clinical crown  
c. Anatomical crown = clinical crown  
d. Any of the above
- 96. Which tooth occupies the centre of the fully developed adult jaw?**  
a. First premolar  
b. Second premolar  
c. Second molar  
d. First molar

83-d, 84-a, 85-a, 86-c, 87-d, 88-c, 89-c, 90-c, 91-a, 92-d, 93-b, 94-a, 95-b, 96-d

97. Deepest position in tooth is  
a. Pit                      b. Fossa  
c. Groove                d. Marginal ridge
98. Transverse ridge is formed by  
a. The junction of the buccogingival ridge with marginal ridge  
b. Joining of buccal and lingual triangular ridges  
c. Junction of two marginal ridge with cingulum  
d. The buccal ridge of distolingual cusp with the lingual ridge of mesiolingual cusp.
99. The nature has provided sufficient overlap of maxillary and mandibular teeth in buccal segment. This is to  
a. Increase chewing efficiency  
b. Add to esthetic value  
c. Prevent soft tissue from cheek bite  
d. None
100. Main function of proximal contact area is  
a. To guide the food over occlusal table  
b. For distribution of occlusal stresses  
c. To prevent impaction of food in interproximal areas  
d. All
101. The tooth anatomy common to anterior teeth only is  
a. Cingulum              b. Fossa  
c. Pits                     d. Marginal ridges
102. Any union of two triangular ridges produces a single ridge which is  
a. Cusp ridge  
b. Transverse ridge  
c. Marginal ridge  
d. Proximal ridge
103. The surfaces of the following teeth have a triangular outline  
a. Mesial and distal of anterior teeth  
b. Mesial and distal of posterior teeth  
c. Labial of anterior teeth  
d. Lingual of anterior teeth
104. The surfaces of the following teeth have a trapezoid outline  
a. Lingual and labial of posterior teeth  
b. Lingual and facial of all teeth  
c. Lingual and labial of anterior only  
d. Proximal of anterior teeth only
105. The divergence of two proximal surfaces from the area of contact facially, lingually, occlusally and gingivally create a space called  
a. A contact area  
b. An occlusal curvature  
c. A gingival space  
d. An embrasure
106. Cemento-enamel junction of teeth curves in the following two directions  
a. Towards the apex on the facial and lingual surfaces  
b. Away from the apex on the facial and lingual surfaces  
c. Away from the apex on the mesial and distal surfaces  
d. Towards the apex on the mesial and distal surfaces  
e. Both a and c
107. The two ridges which are present on all teeth are  
a. Triangular ridge  
b. Mesial and distal cusp ridge  
c. Oblique ridge  
d. Mesial and distal marginal ridge
108. A primary centre of growth or calcification on a tooth is called  
a. Lobe                    b. Ridge  
c. Cingulum            d. Groove
109. The arrangement of natural teeth was first described by  
a. GV Black              b. Bolton  
c. Wilson                d. Graf Von Spee

97-a, 98-b, 99-c, 100-d, 101-a, 102-b, 103-a, 104-b, 105-d, 106-e, 107-d, 108-a, 109-d

**110. Anisognathus refers to**

- a. Unequal teeth
- b. Unequal jaws
- c. Unequal cusps
- d. Nonuniform teeth

**111. The tooth in the closest relation to the zygomatic buttress is**

- a. Maxillary second PM
- b. Maxillary first M
- c. Maxillary second M
- d. Maxillary third M

**112. Humans have two sets of dentition, one primary and the other permanent, such a condition where two sets of teeth are present is called**

- a. Polyphyodonty
- b. Diphyodonty
- c. Monophyodonty
- d. None of the above

**113. The embrasures that increase in size from anterior to posterior are**

- a. Occlusal      b. Lingual
- c. Labial        d. Gingival
- e. a and b

# The Permanent Incisors

## SAQs (3 Marks)

**Q 1. Describe type traits of maxillary incisors.**

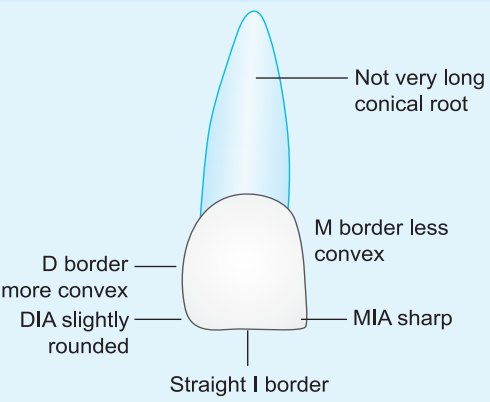
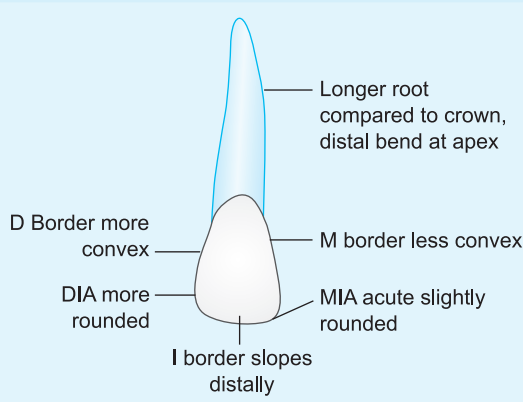
(May 2008, Nov. 2015)

**What are differences between maxillary central and lateral incisor?**

(May 2009)

**Ans.** Incisors are anterior teeth. They are 8 in number, 4 in each arch. Their functions is incising, esthetics, and phonetics.

### Type Traits of Maxillary Incisors

Central incisor (CI)	Lateral incisor (LI)
Labial aspect (La)	
 <p>Not very long conical root</p> <p>D border more convex</p> <p>DIA slightly rounded</p> <p>M border less convex</p> <p>MIA sharp</p> <p>Straight I border</p> <p><b>Fig. 2.1</b></p> <ul style="list-style-type: none"> <li>• Crown has more square or rectangular appearance and smooth surface. It is wider and longer.</li> <li>• The mesial (M) border is less convex distal (D) border is more convex.</li> <li>• Mesioincisal angle (MIA) is sharp and disto-incisal angle (DIA) is rounded.</li> </ul>	 <p>Longer root compared to crown, distal bend at apex</p> <p>D Border more convex</p> <p>DIA more rounded</p> <p>M border less convex</p> <p>MIA acute slightly rounded</p> <p>I border slopes distally</p> <p><b>Fig. 2.2</b></p> <ul style="list-style-type: none"> <li>• Crown is <b>oblong</b>, narrower, shorter and has more curvature.</li> <li>• Same as CI.</li> <li>• Both mesioincisal and disto-incisal angles are rounded, where disto-incisal angle is more rounded.</li> </ul>

(Contd.)

*Central incisor (CI)*

- Mesiodistally the incisal ridge is almost straight.
- Root is cone-shaped with blunt apex.
- In proportion to crown, root is not much longer.

*Lateral incisor (LI) (Contd.)*

- Incisal ridge is rounded. Mesial half is relatively straight and distal half is more rounded curving (sloping) towards the cervical line to join the distal border.
- In proportion to crown, the root is much longer and has a distal bend.

## Lingual view (Li)

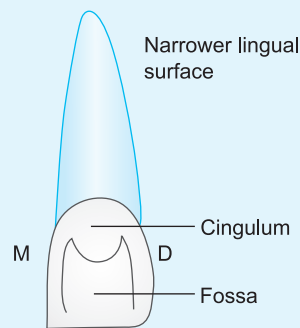


Fig. 2.3

- The crown and root are narrower towards lingual and marginal ridges are less prominent.
- The surface is not smooth.
- There is concavity, fossa in the incisal two-thirds and convexity, cingulum in cervical third.
- Lingual fossa has shallow concavity.
- The **cingulum** is **off-centered to distal** due to which mesial marginal ridge (MMR) is longer than the distal marginal ridge (DMR).
- Developmental grooves extend from cingulum into the fossa.

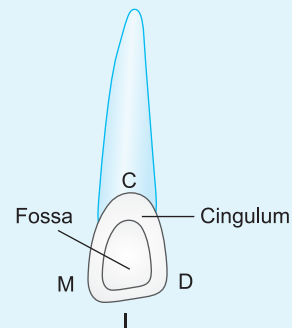


Fig. 2.4

- The crown and root are narrow towards lingual and marginal ridges are prominent.
- Same as CI.
- Same as CI.
- Lingual fossa has more concavity.
- The **cingulum** is **centered** but still the MMR is longer than the DMR due to the slope of the incisal ridge from M to D.
- More often a **deep developmental groove** is present at the distal side of the cingulum which may extend up onto the root.

## Proximal view

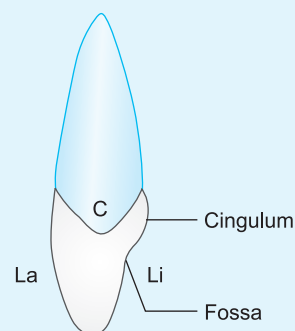


Fig. 2.5

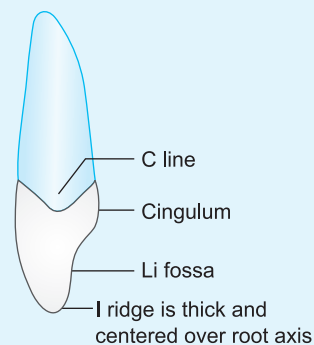


Fig. 2.6

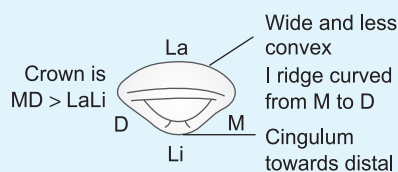
(Contd.)

*Central incisor (CI)*

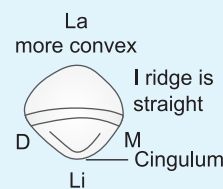
- The outline of the crown is triangular.
- The crown is larger in size.
- Incisal ridge centered over root axis.
- The crest of curvature on both labial and lingual surfaces in the cervical third of the crown.
- Crown from this aspect appears thicker in the incisal third due to distolingual slope of the labial surface.
- The cervical line curvature on mesial aspect is more than that on the distal aspect. The cervical curvature is greater on the mesial surface of this tooth than on any other tooth in the mouth.
- Root from this aspect is conical and apex bluntly rounded.

*Lateral incisor (LI) (Contd.)*

- The outline of crown is also triangular.
- The crown is **shorter**.
- The incisal ridge is centered over root axis.
- The crest of curvature on both labial and lingual surfaces is in cervical third of the crown.
- Crown from this aspect appears thicker because of the more rounded distoincisal angle.
- The cervical line curvature on mesial aspect is more than that on the distal aspect.
- Root from this aspect is conical, **longer** and has a pointed apex.

**Incisal aspect (I)****Fig. 2.7**

- The crown outline is **triangular**
- Crown is wider mesiodistally than labiolingually.
- Labial outline is broad and flat **compared to lingual**.
- The incisal ridge is slightly curved from mesial to distal.

**Fig. 2.8**

- The crown outline is **ovoid**.
- The crown may be wider labiolingually than mesiodistally (MD).
- Labial and lingual outlines are more convex.
- The incisal ridge is straight.

**Q 2. Describe the roots of anterior teeth.***(June 2010)***Ans.**

- More often the anterior teeth have single roots.
- The roots taper from cervix to apex.
- The roots are wider on labial than on lingual.
- The roots are wider faciolingually than mesiodistally except maxillary central incisor where the root is conical.
- The roots may have a distal bend at the apex except in the root of the maxillary central incisor.
- Roots are longer than the crown except in case of maxillary CI where the root is not much longer than the crown.
- Maxillary incisors have developmental depressions on the mesial surface.
- Mandibular incisors, maxillary, and mandibular canines have root depressions on both M and D surfaces with distal depression being more distinct.
- Maxillary canine has the longest root of all the teeth.



**Q 3. What are variations in permanent maxillary incisors?**

(Nov. 2010)

**Ans. Central Incisor**

- Hutchinson's incisors are found in congenital syphilis. They are screw-driver shaped with notched incisal edge.
- Central incisors may have very short root or very long root.
- Talon's cusp, fusion, gemination may be found.
- Shovel-shaped CI is one of the variations found in maxillary CI.

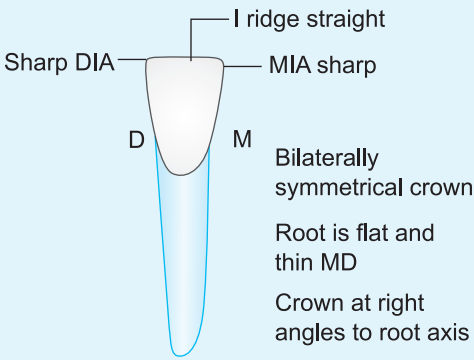
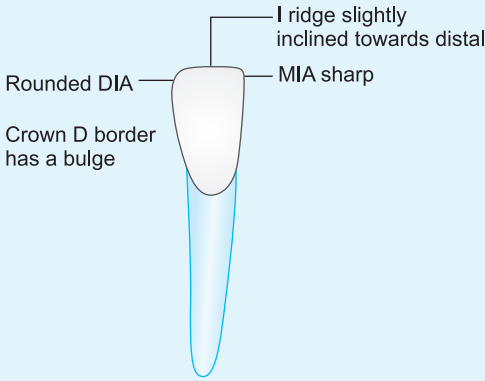
**Lateral Incisor**

- **Peg-shaped** is relatively common.
- The crown may be distorted.
- The tooth may be missing.
- The tooth may have a twisted root.
- Incisal side of cingulum may show a tubercle.
- Talon's cusp, an accessory cusp may be present on the lingual surface.
- Lingual surface may have a deep lingual pit.
- **Deep palatogingival groove** from cingulum to root may be present.

**Q 4. Explain about type traits of permanent mandibular incisors.****Ans.** Mandibular incisors are 4 in number.

They have uniform development and have narrowest of mesiodistal dimension.

**Type Traits of Mandibular Incisors**

Central incisor (CI)	Lateral incisor (LI)
Labial aspect (La)	
 <p>Sharp DIA</p> <p>I ridge straight</p> <p>MIA sharp</p> <p>D M</p> <p>Bilaterally symmetrical crown</p> <p>Root is flat and thin MD</p> <p>Crown at right angles to root axis</p> <p><b>Fig. 2.9</b></p>	 <p>I ridge slightly inclined towards distal</p> <p>MIA sharp</p> <p>Rounded DIA</p> <p>Crown D border has a bulge</p> <p><b>Fig. 2.10</b></p>
<ul style="list-style-type: none"> <li>• The labial surface is regular and convex.</li> <li>• The crown is long and narrow and is bilaterally symmetrical.</li> <li>• Mesial and Distal incisal angles (MIA and DIA) are sharp (90°).</li> </ul>	<ul style="list-style-type: none"> <li>• Same as central incisor.</li> <li>• The crown is slightly wider and longer than that of central incisor and is not bilaterally symmetrical.</li> <li>• MIA is sharp whereas DIA is rounded.</li> <li>• DIA is rounded.</li> </ul>

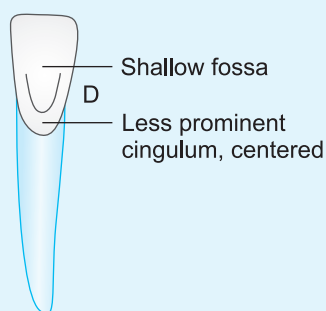
(Contd.)

*Central incisor (CI)*

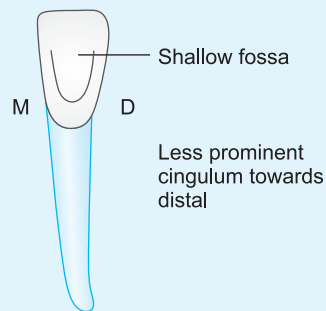
- Incisal ridge (IR) is straight and at right angles to long axis.
- The root from this aspect is very thin mesiodistally.
- It may have a distal bend in the apical third.

*Lateral incisor (LI) (Contd.)*

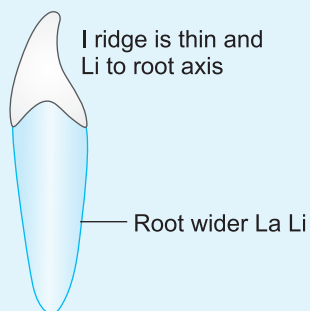
- Incisal ridge is not straight.
- Same as that of CI.
- The root is longer and may have a distal bend.

**Lingual aspect (Li)****Fig. 2.11**

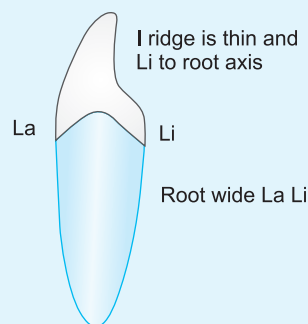
- The lingual surface is smooth and shallow.
- The cingulum is small, convex, and centered.
- No developmental grooves or pits.
- M and D developmental grooves on roots are visible from this aspect.

**Fig. 2.12**

- Same as central incisor.
- The cingulum is small, convex and off-centered to distal.
- Same as central incisor.
- Same as central incisor.

**Proximal aspect****Fig. 2.13**

- Mesial (M) and distal (D) surfaces are wedge-shaped.
- M and D surfaces are similar.
- The incisal ridge is on or lingual to the root axis.
- Crest of curvature on both labial and lingual surfaces is in the cervical third of the crown.
- The cervical line curvature on mesial is more than on distal surface.

**Fig. 2.14**

- Same as central incisor.
- M side of the crown is longer than the distal side.
- The distoincisor twist of the incisal ridge places the distal portion of the incisal ridge more lingual than mesial portion.
- Same as central incisor.
- Same as central incisor.

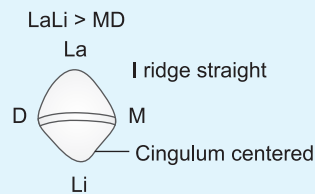
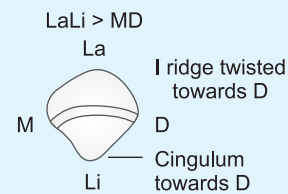
(Contd.)

*Central incisor (CI)*

- The root from this aspect is wider labiolingually (LaLi) than mesiodistally (MD)
- Developmental depressions present on both M and D surface of the root.

*Lateral incisor (LI) (Contd.)*

- Same as central incisor.
- Same as central incisor.

**Incisal aspect (I)****Fig. 2.15****Fig. 2.16**

- The tooth is bilaterally symmetrical. Mesial half is identical with the distal half.
- Incisal ridge is straight and at right angles to the line bisecting the cingulum.
- Labiolingually (LaLi) dimension > mesiodistally (MD) dimension.
- Labial (La) surface wider than lingual surface (Li).
- Cingulum is centered.
- It is not bilaterally symmetrical.
- Incisal ridge not straight twisted towards distal. It follows the curvature of the mandibular arch.
- Same as central incisor.
- Same as central incisor.
- Cingulum is toward distal.

## MULTIPLE CHOICE QUESTIONS (MCQs)

1. The scallops found on the newly erupted teeth are known as
  - a. Perikymata
  - b. Mamelons
  - c. Imbrication lines
  - d. None of the above
2. All incisors have roots wider faciolingually than mesiodistally *except*
  - a. Maxillary central incisors
  - b. Maxillary lateral incisors
  - c. Mandibular central incisors
  - d. Mandibular lateral incisors
3. The incisal wear pattern on maxillary incisors is as
  - a. Incisal edge slopes cervically towards labial
  - b. Incisal edge slopes cervically towards lingual fossa
  - c. Incisal edge with no slope
  - d. None of the above
4. In mandibular incisors the incisal edge wear slopes
  - a. Cervically towards labial
  - b. Cervically towards lingual fossa
  - c. Neither labially nor lingually
  - d. None of the above
5. For all human teeth, contact areas are located
  - a. In incisal or occlusal thirds
  - b. At the junction of incisal and middle thirds
  - c. Cervical thirds
  - d. Both a and b
6. Maxillary central incisor is generally considered to be a poor abutment tooth when making a dental bridge because
  - a. Of its position
  - b. Root being short and conical
  - c. Due to size of the crown
  - d. None of the above
7. The mesial curvature of the cervical line is deepest on which of the following?
  - a. Mandibular central incisors
  - b. Maxillary canine
  - c. Maxillary central incisors
  - d. Maxillary lateral incisors.
8. The distal marginal ridge is shorter in both, the maxillary central incisors and maxillary lateral incisors because
  - a. In central incisors the cingulum is located off center to the distal side
  - b. In lateral incisors the incisal edge slopes cervically from mesial to distal
  - c. Both a and b
  - d. None of the above
9. A longitudinal depression is found on the middle of the mesial surface of the root of
  - a. Maxillary central incisors
  - b. Maxillary lateral incisors
  - c. Both
  - d. None of the above
10. The incisor more likely to have a bifurcated root is a variation found in
  - a. Maxillary lateral incisors
  - b. Mandibular central incisors
  - c. Mandibular lateral incisors
  - d. Maxillary central incisor
11. Shovel shaped incisors and a deep groove running cervicoincisally on the cingulum are associated with dentition in the following ethnic group
  - a. Caucasian
  - b. Negro
  - c. Mongoloid
  - d. None of the above
12. The only incisor that is symmetrical, having M and D contact points at the same level and is difficult to tell Right from Left is
  - a. Maxillary central incisors
  - b. Mandibular central incisors
  - c. Mandibular lateral incisors
  - d. Maxillary lateral incisor

1-b, 2-a, 3-b, 4-a, 5-d, 6-b, 7-c, 8-c, 9-c, 10-c, 11-c, 12-b

- 13. The labiolingual dimension is more than mesiodistal dimension in**
- Maxillary central incisors
  - Maxillary lateral incisors
  - Mandibular incisors
  - Both a and b
- 14. From proximal view, incisal edge is lingual to mid root axis, root is thin mesiodistally with inconspicuous marginal ridges and lingual fossa, is characteristic of**
- Maxillary incisors
  - Mandibular incisors
  - Maxillary canine
  - Mandibular canine
- 15. Longitudinal root depressions on both M and D root surface is characteristic of**
- Maxillary incisors
  - Mandibular incisors
  - Premolars
  - Molars
- 16. The cingulum is centred in**
- Maxillary central incisors and mandibular central incisors
  - Maxillary lateral incisors and mandibular lateral incisors
  - Maxillary lateral incisors and mandibular central incisors
  - Only maxillary central incisors
- 17. Palatal gingival groove, peg-shape, missing tooth are the variations found in**
- Maxillary lateral incisors
  - Mandibular lateral incisors
  - Mandibular canines
  - Maxillary central incisors
- 18. Crown bent distally on root, the bulge on the distal side of the crown and distal placement of the cingulum are characteristics of**
- Maxillary lateral incisors
  - Mandibular lateral incisors
  - Maxillary central incisors
  - Mandibular canine
- 19. In maxillary central incisors outline of the pulp chamber is**
- Round
  - Oval
  - Triangular
  - Square shaped
- 20. The distolingual twist of the incisal edge to the root axis is common to**
- Mandibular central incisors
  - Mandibular lateral incisors
  - Both a and b
  - None of the above
- 21. Most common incisors to show morphologic variation is**
- Permanent maxillary lateral incisors
  - Permanent mandibular central incisors
  - Deciduous maxillary central incisors
  - Permanent mandibular lateral incisor
- 22. The apex of the roots are generally tilted to**
- Buccal side
  - Lingual side
  - Distal side
  - Mesial side
- 23. The only root which is triangular in cross-section at cervix is of**
- Maxillary canine
  - Maxillary lateral incisor
  - Maxillary central incisor
  - Mandibular central incisor
- 24. The curve of the cervical line is deepest incisally on the mesial surface of**
- Maxillary central incisors
  - Maxillary lateral incisors
  - Mandibular central incisors
  - Mandibular lateral incisors
- 25. A deep lingual pit is usually found on the lingual surface of**
- Permanent maxillary central incisors
  - Permanent maxillary lateral incisors
  - Permanent maxillary canine
  - Permanent maxillary mandibular incisors

13-c, 14-b, 15-b, 16-c, 17-a, 18-b, 19-c, 20-b, 21-a, 22-c, 23-c, 24-a, 25-b

26. The tooth least likely to have a divided pulp canal is
- Maxillary central incisor
  - Maxillary first PM
  - Mandibular central incisor
  - Mandibular first PM
27. The mesial contact area between the two maxillary and the two mandibular central incisors is present in the
- Incisal third
  - Middle third
  - Cervical third
  - At the junction of middle and cervical third
28. The first evidence of calcification of permanent central incisors take place at
- 3–4 months after birth
  - 3–4 months in intrauterine life
  - 6 months after birth
  - 8 months after birth
29. The first evidence of calcification of permanent maxillary LI takes place at
- 8 months in intrauterine life
  - 8 months in after birth
  - 10 to 12 months after birth
  - At birth
30. Eruption of permanent maxillary CI takes place at the age of
- 4–5 years
  - 6–7 years
  - 7–8 years
  - 9–10 years
31. Eruption of permanent maxillary LI takes place at the age of
- 6–7 years
  - 7–8 years
  - 8–9 years
  - 9–10 years
32. The crown completion of permanent central incisors takes place at the age?
- 4–5 years
  - 5–6 years
  - 6–7 years
  - 3–4 years
33. The first evidence of calcification of permanent mandibular LI takes place at the age of
- 3–4 months after birth
  - 3–4 years after birth
  - 3–4 months in intrauterine life
  - 6–8 months in intrauterine life
34. In all the permanent incisors first evidence of calcification takes place at about 3½ months after birth except
- Maxillary central incisor
  - Maxillary lateral incisor
  - Mandibular central incisor
  - Mandibular lateral incisor.
35. An anatomic feature that is most likely to complicate root planing of a maxillary lateral incisor is
- A root bifurcation
  - A mesial concavity
  - An enamel projection
  - A distolingual groove
36. The following structure calcifies first in an anterior tooth
- Cingulum
  - Cervical ridge
  - Marginal ridge
  - Incisal ridge
37. The wear facets on the incisal edges of the mandibular lateral incisors are caused by occlusion with the
- Maxillary central incisors only
  - Maxillary central and lateral incisors
  - Maxillary lateral incisors and canines
  - None of the above
38. Developmental depressions are not present on both mesial and distal surfaces of the roots of permanent.
- Mandibular central incisors
  - Maxillary central incisors
  - Maxillary canine
  - None of the above

26-a, 27-a, 28-a, 29-c, 30-c, 31-c, 32-a, 33-a, 34-b, 35-d, 36-d, 37-b, 38-b

- 39. The maxillary permanent central incisor develops from**
- a. Two lobes and has two mamelons
  - b. Four lobes and has three mamelons
  - c. Three lobes and has three mamelons
  - d. Four lobes and has two mamelons
- 40. The permanent anterior tooth which may have a lingual groove extending from enamel to cementum of root**
- a. Maxillary canine
  - b. Maxillary lateral incisor
  - c. Maxillary central incisor
  - d. None of the above.
- 41. The permanent anterior tooth having developmental grooves extending from the cingulum into the lingual fossa is**
- a. Maxillary central incisor
  - b. Mandibular central incisor
  - c. Mandibular lateral incisor
  - d. Mandibular canine
- 42. The root of permanent tooth which is completed by 10 years is**
- a. Maxillary central incisors
  - b. Maxillary first molars
  - c. Mandibular first molars
  - d. None of the above
- 43. Depressions on the M and D aspect of the root is seen in**
- a. Mandibular central and lateral incisors
  - b. Maxillary canines
  - c. Maxillary central and lateral incisors
  - d. Maxillary first premolars



# The Permanent Canines

## LAQ (10 Marks)

**Q 1. Compare and contrast maxillary canine with mandibular canine in tabular form.**

(June 2006)

**Ans.**

### Maxillary canine

#### Introduction:

It is the third tooth from the midline in the maxillary arch.

#### Numbering system:

Palmer	<u>3</u>	<u>3</u>
Universal	Right-6	Left-11
F.D.I.	Right-13	Left-23

#### Chronological data:

First evidence of calcification	4–5 months
Enamel completion	6–7 years
Eruption	11–12 years
Root completion	13–15 years

### Mandibular canine

#### Introduction:

It is the third tooth from the midline in the mandibular arch.

#### Numbering system:

Palmer	<u>3</u>	<u>3</u>
Universal	Right-27	Left-22
FDI	Right-43	Left-33

#### Chronological data:

First evidence of calcification	4–5 month
Enamel completion	6–7 years
Eruption	9–10 years
Root completion	12–14 years

### Canine from each aspect

#### Labial aspect (La) (SAQ, Nov. 2015)

#### Crown:

##### Shape, size, and surface:

- It has trapezoid or pentagon shape due to 2 incisal ridges meeting at cusp tip which is pointed.
- The length of the crown is short – (10 mm). It is 7.5 mm wide at contact area and 5.5 mm wide at cervix.
- The labial ridge (LaR) is more prominent.

#### Crown:

##### Shape, size, and surface:

- It also has pentagon shape with two incisal ridges meeting at cusp tip which is not pointed.
- The crown is **longer** (11 mm), and **narrower**. It is 7 mm wide at contact area and 5.5 mm wide at cervix.
- The labial ridge is not prominent.

(Contd.)

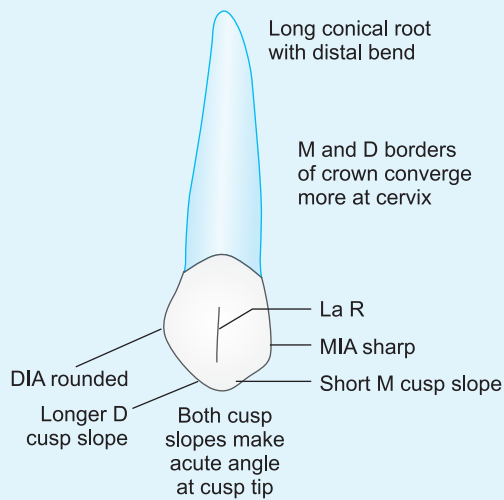
*Maxillary canine*

Fig. 3.1

*Outlines:*

- The mesial (M) and distal (D) outlines of the crown **converge towards the cervix**
- The M outline is convex from cervix to the contact point.
- D outline is concave near the cervix and convex at the contact point.
- Mesial cusp slope (MCS) is shorter than the distal cusp slope (DCS). Both the cusp slopes may have concavity before wear.
- M and D cusp slopes make an **acute angle** at the cusp tip which is centred over the root axis.
- The cusp slopes and the cusp make-up for the **incisal one-third** of the crown.
- The cervical line is convex towards the root apex.
- Mesioincisal angle (MIA) is sharp. Distoincisal angle (DIA) is rounded.

*Contact point:*

- Mesial contact point is at the **junction of incisal and middle third**.
- Distal contact point is in the middle third of the crown and is rounded.
- M and D contact areas are at different levels.

*Root:*

- The root is long, (17 mm), slender, and conical.
- The apex is bluntly pointed and may have a distal bend.

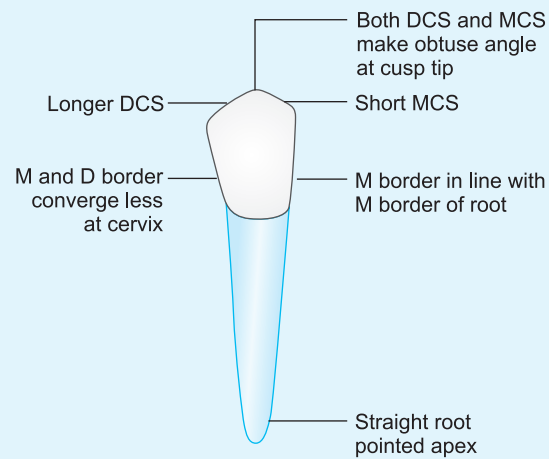
*Mandibular canine (Contd.)*

Fig. 3.2

*Outlines:*

- The mesial and distal outlines of the crown are **less converging**, they are more or less parallel.
- M outline of the crown is more or **less straight** in line with the mesial outline of the root.
- D outline is slightly concave in the cervical third.
- It is same as Maxillary Canine.
- M and D cusp slopes make an **obtuse angle** at the cusp tip which is centered over the root axis.
- The cusp slopes and the cusp make-up for the **incisal one-fifth** of the crown.
- The cervical line is convex towards the root apex.

*Contact point:*

- Mesial contact point is in the **incisal third** near the mesioincisal angle.
- Distal contact point is cervical to the mesial contact point.

*Root:*

- The root is 16 mm. It is **shorter** and **narrower** mesiodistally than that of maxillary canine.
- The apex is sharply pointed.

(Contd.)

## Maxillary canine

## Mandibular canine (Contd.)

## Lingual aspect (Li)

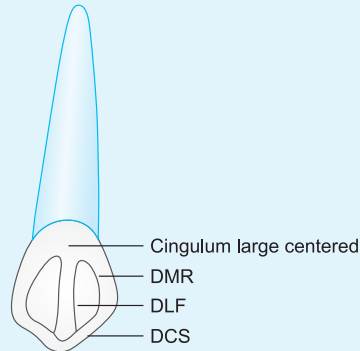


Fig. 3.3

**Crown:***Shape, size, and surface:*

- The crown and root are narrower towards lingual.
- The **lingual ridge (LiR)** is prominent, runs from the cusp tip to the cingulum.
- The lingual surface is not **smooth**.
- The mesial and distal fossa (MLF and DLF) lie on either side of the lingual ridge and are usually shallow. Marginal ridges are strongly developed.
- The cingulum is large and centered and in some cases it is pointed like a small cusp or tubercle.

*Outline:*

- Outlines are similar to the labial surface.
- The mesial marginal ridge (MMR) is longer compared to the (DMR) because of the shorter mesial cusp slope.

**Root:**

- Root is narrow on the lingual side therefore it is possible to see the M and D surfaces of the root as well as the M and D developmental depressions.

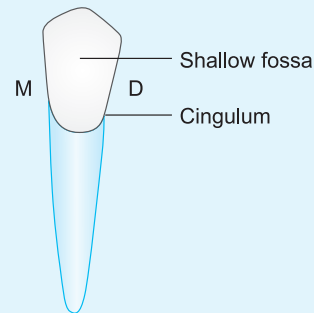


Fig. 3.4

**Crown:***Shape, size, and surface:*

- Same as maxillary canine.
- The lingual ridge is faint except at the cusp tip where it may be raised.
- The lingual surface is smooth regular and flatter.
- Fossa is less prominent. Marginal ridges are less distinct.
- The cingulum is smooth and poorly developed and off-centred distally or may be centered.

*Outline:*

- Outlines are similar to the labial surface.
- MMR is longer because of shorter mesial cusp slope as well as the cingulum being off-centred to distal.

- The lingual portion of the root is relatively narrower than that of the maxillary canine.

## Proximal aspect

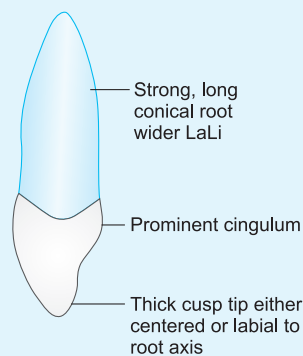


Fig. 3.5

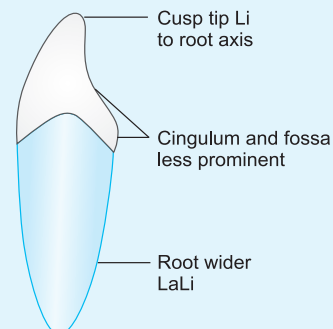


Fig. 3.6

(Contd.)

*Maxillary canine***Crown:***Shape, size, and surface:*

- The crown is wedge-shaped with smooth surface.
- Mesial surface is convex except the area between the contact point and the cervical line which is slightly concave or flat.
- On the distal surface there is more concavity in the area between the contact point and the cervical line.

*Outlines:*

- The labial (La) outline of the crown is more convex in the cervical third and is less convex in the incisal two-thirds and becomes more or less straight near the cusp.
- The lingual (Li) outline is represented by a convex line describing the cingulum. In the middle third the outline is straight and becomes convex again in the incisal third.
- The crest of curvature on both labial and lingual surface is in the cervical third of the crown which shows **greater bulk labiolingually (LaLi)** than any other anterior tooth.
- The cusp tip is thicker labiolingually and is located either labial to root axis or centred over it.
- The cervical line curvature is towards incisal and more so on the mesial surface than on the distal surface.
- Distoincisor angle (DIA) is in line with the mesio-incisor angle (MIA).

**Root:**

- Root is wide labiolingually in cervical third and middle third, it tapers at the apex. Labial outline is slightly convex while lingual outline is more convex.
- Developmental depression on the distal surface is more pronounced whereas mesial depression is shallow.

*Mandibular canine (Contd.)***Crown:***Shape, size, and surface:*

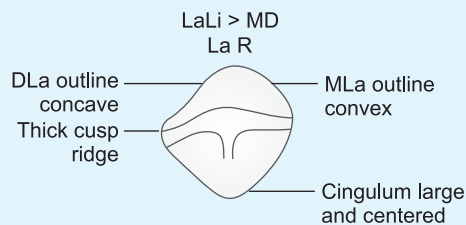
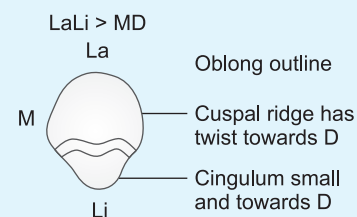
- It is same as maxillary canine.
- Mesial surface is not convex except at the contact point.
- On the distal surface there is more concavity in the area between the contact point and the cervical line.

*Outlines:*

- The labial (La) outline has very less curvature, with very little curvature directly above the cervical line.
- The lingual (Li) outline is very less convex. Cingulum is low and somewhat flattened. There is almost continuous crown-root outline.
- The crest of curvature on both labial and lingual surfaces is in the cervical third but the bulk is much less and closer to the cervical line.
- The cusp tip is thinner labiolingually and is located lingual to the root axis or may be centered over it.
- The cervical line curvature is more on the mandibular than on the maxillary canine and more so on the mesial surface than the distal surface.
- Distoincisor angle is slightly more lingually placed than the cusp tip because of the distolingual twist of the crown, so much so that the lingual surface is visible from the mesial aspect.

**Root:**

- Root from this aspect is very similar to that of maxillary canine except that the root tip is more pointed.
- Both the M and D root depressions are more pronounced in the apical third.

**Incisal aspect****Fig. 3.7****Fig. 3.8**

(Contd.)

*Maxillary canine*

- The crown outline is not symmetrical.
- Labiolingual dimension (Lali) is more than mesiodistal (MD) dimension.
- Labial outline is convex due to prominent labial ridge.
- The mesial half of the labial surface (MLa) is very much convex while the distal half (DLa) is slightly concave giving it the appearance as if it is pinched or stretched to make contact with the first premolar.
- The **cingulum** is **large** and **centered** mesiodistally.
- The incisal ridge is straight mesiodistally.
- The tip of the cusp is labial to the centre of the crown labiolingually and mesial to the centre mesiodistally.

*Mandibular canine (Contd.)*

- The crown outline is more symmetrical.
- The labiolingual dimension is noticeably larger than mesiodistal dimension.
- Oblong labiolingual outline is characteristic of mandibular canine.
- Mesiolabial outline is convex, distolabial outline flat or slightly concave.
- The cingulum is **small** and **off-centred to distal**.
- The incisal ridge is not straight it has a distolingual twist.

**SAQ (3 Marks)****Q 1. What are class traits of canines?***(May 2014)***Ans. Class Traits of Canines**

- Canine is the longest tooth in the oral cavity.
- **Maxillary canine has a functional lingual surface.**
- It has a single pointed cusp. Incisal ridge of canine is divided into two inclines or slopes by a cusp as opposed to a straight ridge in the incisors, which gives the crown a pentagon shape. The mesial slope is shorter than the distal slope. Canine does not have mamelons but may have a notch on either of the cusp slope.
- It has a single, longest and strongest root of all the teeth providing best anchorage amongst all anterior teeth.
- **It is the only anterior tooth with a labial ridge.**
- Canines typically have mesial and distal contact areas at different levels cervicoincisally because of the mesial and distal contact with different classes of teeth.

## MULTIPLE CHOICE QUESTIONS (MCQs)

1. The longest teeth in the mouth are
  - a. Canines
  - b. Incisors
  - c. Premolars
  - d. Molars
2. The feature that distinguishes maxillary canine from mandibular canine are
  - a. The pointed, acute angle at cusp tip and constriction of crown at the cervix
  - b. Asymmetrical outline from incisal view
  - c. Both a and b
  - d. Symmetrical outline from incisal view
3. Mesiodistal dimension of this tooth is less than labiolingual dimension
  - a. Permanent maxillary central incisor
  - b. Permanent maxillary canine
  - c. Permanent maxillary lateral incisor
  - d. None
4. The characteristic that differentiates maxillary canine from mandibular canine
  - a. Cusp tip labial to centre
  - b. Attrition on lingual surfaces
  - c. Cingulum is centred
  - d. All of the above
5. The tooth having mesial side of the crown in line with mesial side of the root is
  - a. Maxillary canine
  - b. Mandibular canine
  - c. Mandibular lateral incisor
  - d. Maxillary central incisor
6. The cingulum is off centred to distal in
  - a. Permanent maxillary central incisor
  - b. Mandibular lateral incisor
  - c. Mandibular canine
  - d. All the above
7. The canine eminence ridge on the anterior surface of maxilla, forms the following fossa anterior to it
  - a. Incisive fossa
  - b. Canine fossa
  - c. Triangular fossa
  - d. Central fossa
8. The anterior teeth most likely to have a bifurcated root is
  - a. Permanent maxillary canine
  - b. Permanent mandibular lateral incisor
  - c. Permanent mandibular canine
  - d. Permanent maxillary lateral incisor
  - e. Both b and c
9. The distinguishing features between maxillary right and left canine are
  - a. Shorter mesial cusp slope
  - b. Mesioincisal angle sharp, distoincisor rounded
  - c. Mesial cervical line is more convex
  - d. All the above
10. The surface of mandibular canine crown which is relatively straight and is in continuation with the same on the root is
  - a. Mesial
  - b. Labial
  - c. Lingual
  - d. Distal
11. The permanent tooth in the oral cavity having the longest crown length is
  - a. Maxillary canine
  - b. Mandibular lateral incisor
  - c. Maxillary 1st premolar
  - d. Mandibular canine
12. Anterior teeth having two roots, i.e. root divided into labial and lingual part is variation found in
  - a. Maxillary canine
  - b. Mandibular canine
  - c. Maxillary incisor
  - d. Mandibular incisor (lateral)
  - e. Both b and d
13. From incisal view distolingual twist of the crown is common to
  - a. Mandibular canine
  - b. Mandibular lateral incisor
  - c. Both a and b
  - d. Maxillary central incisor

1-a, 2-c, 3-b, 4-d, 5-b, 6-d, 7-a, 8-e, 9-d, 10-a, 11-d, 12-e, 13-c

14. From incisal aspect the labial outline of the crown appears to be pinched faciolingually on the distal half, this is the characteristic of
- Maxillary canine
  - Mandibular canine
  - Both maxillary and mandibular canine
  - None of the above
15. From incisal view, compared to the axis of the root, the cusp tip of maxillary canine is placed
- Labially and distally
  - Labially and mesially
  - Lingually and distally
  - Lingually and mesially
16. The largest labiolingual root dimension is of
- Maxillary central incisor
  - Maxillary lateral incisor
  - Maxillary canine
  - Mandibular canine
17. On the lingual surface (in cingulum region) of permanent maxillary canine is a sharp cusp like eminence called
- Lobe
  - Tubercle
  - Mamelon
  - Perikymata
18. The fossa above the roots of premolars, posterior to canine eminence on maxilla is
- Canine fossa
  - Incisive fossa
  - Linear fossa
  - Central fossa
19. Of the four cusp ridges the longest cusp ridge of the permanent canines is
- Labial ridge
  - Lingual ridge
  - Mesial ridge
  - Distal ridge
20. The permanent maxillary canine is most likely to occlude with mandibular
- Lateral incisor and canine
  - Canine only
  - Canine and first premolar
  - First premolar only
21. The first evidence of calcification of permanent maxillary canine takes place at the age of
- 4–5 months after birth
  - 4–5 years after birth
  - 6 months in intrauterine life
  - None of the above
22. The crown completion of permanent maxillary canine is at
- 6–7 years
  - 4–5 years
  - 7–8 years
  - 8–9 years
23. When a permanent mandibular canine has more than one root, usually the position of the root is
- Mesial and distal
  - Facial and lingual
  - Mesial and lingual
  - Distal and facial.
24. The distal contact point of maxillary canine is usually located at
- Junction of middle and cervical third
  - Middle of cervical third
  - Middle third
  - Junction of incisal and middle third
25. In a maxillary canine, from proximal aspect the line bisecting the root apex will pass
- Labial to the cusp tip
  - Lingual to the cusp tip
  - Through the cusp tip
  - None of the above

# Premolars

## LAQs (10 Marks)

**Q 1. Describe class and arch traits of premolars. Compare and contrast maxillary first and second premolars.** *(June 2011)*

**Ans. Class Traits of Premolars**

- Premolars have a single buccal (B) cusp.
- They usually have two cusps, one buccal and one lingual and are called bicuspid but the term is misnomer because very often mandibular second premolar may have three cusps.
- They may have one or two roots.

**Arch Traits of Premolars** (SAQ, Oct. 2003, Nov. 2010, 2014)

- Maxillary first premolars are larger than the second premolars whereas mandibular first premolars are smaller than the second premolars.
- Maxillary first and second premolars are more similar to each other as compared to mandibular first and second premolars.
- Maxillary premolars usually erupt before the eruption of maxillary canines.
- Mandibular premolars usually erupt after the eruption of mandibular canines.
- From proximal view
  - Mandibular premolar crowns appear to be tilted lingual to the root axis.
  - In mandibular premolars the lingual cusps are much shorter than the buccal cusps as compared to those of maxillary premolars.
  - Mandibular premolars show rhomboid outline from this aspect due to the lingual tilt of the crown whereas maxillary premolars show trapezoid outline from this aspect.
- From occlusal view
  - The maxillary premolars have hexagonal or ovoid outline.  
The crown is wider buccolingually than mesiodistally.
  - The mandibular premolars have more or less square outline or rounded or ovoid.
  - Lingual cusp-tips are off-centered to the mesial most often on maxillary premolars and may be off-centered to mesial on mandibular first premolars and second premolars with two cusps.
  - Mandibular premolars exhibit more variation in occlusal form as compared to maxillary premolars.



*Maxillary first premolar***Introduction:**

- It is located fourth from the midline and contacts maxillary canine mesially and maxillary second premolar distally.
- It is larger than the second premolar.

**Numbering system:**

Palmer	<u>4</u>	<u>4</u>
Universal	R # 5	L # 12
FDI	14	24

**Chronological data:**

First evidence of calcification	1½–13/4 yrs
Enamel completed	5–6 yrs
Eruption	10–11 yrs
Root completed	12–13 yrs

*Maxillary second premolar***Introduction:**

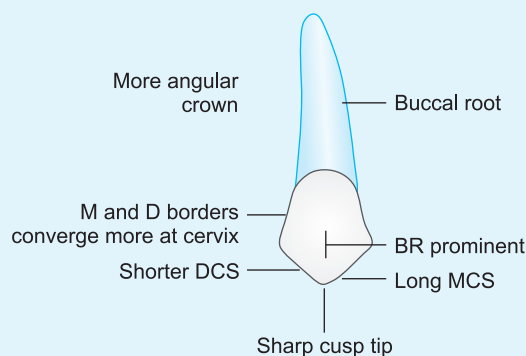
- It is located fifth from the midline and contacts maxillary first premolar mesially and maxillary first molar distally.
- It is smaller than the first premolar.

**Numbering system:**

Palmer	<u>5</u>	<u>5</u>
Universal	R # 4	L # 13
FDI	15	25

**Chronological data:**

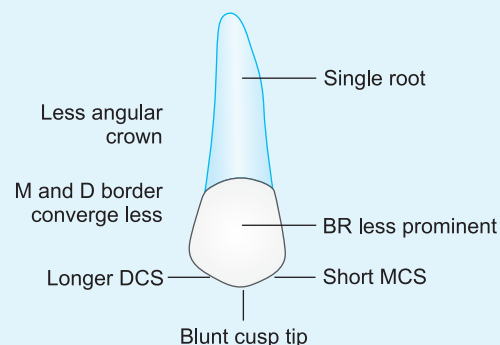
First evidence of calcification	2–21/4 yrs
Enamel completed	6–7 yrs
Eruption	10–12 yrs
Root completion	12–14 yrs

**Buccal aspect (B)****Fig. 4.1****Crown:***Shape, size, and surface:*

- The crown has pentagon/trapezoid shape.
- The outlines are **more angular**.
- The crown is longer than that of the second premolar.
- Buccal surface (B) is convex with more **prominent buccal ridge (BR)**.

*Outlines:*

- The mesial (M) and distal (D) outlines of the crown **converge** towards the cervix.
- Mesial outline is slightly concave from cervix to the contact point whereas distal outline is almost straight.
- The buccal cusp tip is long and pointed resembling canine but contact areas in this tooth near at same level.

**Fig. 4.2****Crown:***Shape, size, and surface:*

- Same as that of first premolar.
- The outlines are **less angular**.
- The crown is not as long as that of first premolar.
- The buccal ridge is **less prominent**.

*Outlines:*

- The mesial and distal outlines **converge less** as compared to that of first premolar.
- Mesial outline is slightly convex whereas distal outline is more convex.
- The buccal cusp tip is short and blunt.

(Contd.)

*Maxillary first premolar*

- Location of buccal cusp tip is towards distal with a longer mesial cusp slope (MCS).
- Mesial and distal cusp slopes (DCS) meet at right angles at the cusp tip.
- Cervical line is convex towards the root apex.
- Mesial contact point lies at the junction of occlusal and middle third and it is narrower as compared to the distal contact point.
- The distal contact point lies in the middle third of the crown and slightly cervical to the mesial contact point.

**Root:**

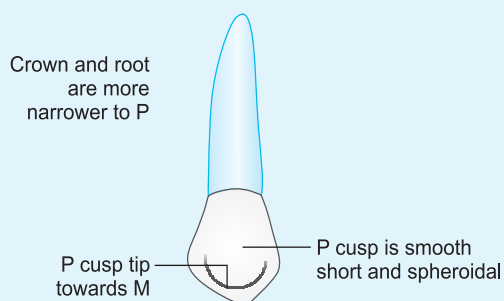
- The root tapers from cervix to the apex
- Apex of the root may bend distally, mesially or may be straight.

*Maxillary second premolar (Contd.)*

- Location of buccal cusp tip is **towards mesial with a shorter mesial cusp slope**.
- M and D cusp slopes meet at an obtuse angle at the cusp tip.
- Same as that of first premolar.
- Mesial contact point is at the junction of the occlusal and middle third.
- Distal contact point same as that of first premolar.
- Both the contact points are broader because the crown is in contact with posterior teeth.

**Root:**

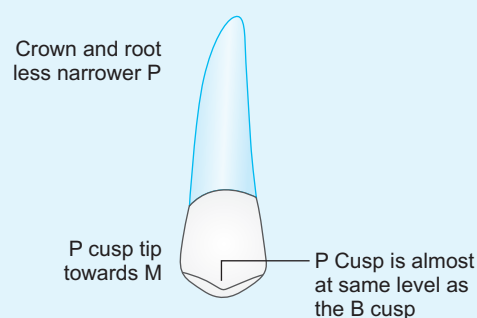
- Same as that of first premolar.
- Same as that of first premolar.

**Palatal aspect (P)****Fig. 4.3****Crown:**

- Crown is narrower on the palatal side.
- Palatal (P) cusp is smooth, spheroidal and shorter than the buccal (B) cusp.
- The tip of the unworn palatal cusp is placed mesially. The cusp tip is pointed.
- Because the palatal cusp is narrower and shorter than the buccal cusp, part of the M and D surfaces of the crown and root are seen from this aspect, and also the cusp tips and cusp slopes of both the buccal and palatal cusps are seen from this aspect.
- M and D outlines are convex and are continuous with the MCS and DCS.

**Root:**

- The palatal root of the two rooted first premolar is smooth, convex, and shorter than the buccal roots.
- The apex of the palatal root is blunt and may have a mesial or distal bend.

**Fig. 4.4****Crown:**

- The crown is less narrow on the palatal side.
- Palatal cusp is almost of the same height as the buccal cusp.
- Same as that of first premolar.
- The palatal cusp is almost as long as the buccal cusp. The palatal cusp is slightly narrower than the buccal cusp.

**Root:**

- The single root is narrow towards the palatal aspect.

(Contd.)

## Maxillary first premolar

## Maxillary second premolar (Contd.)

## Proximal aspect

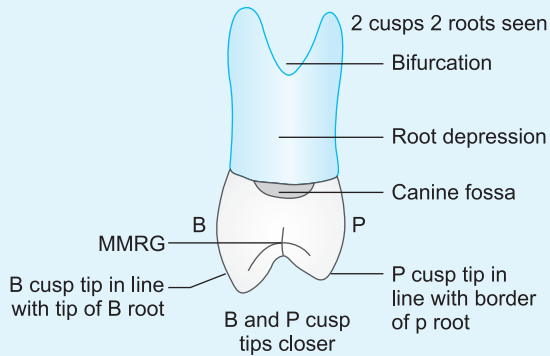


Fig. 4.5

**Crown:***Shape, cusp tips, and cusps:*

- Proximal surface has trapezoid shape.
- Two cusps are seen from this aspect. The buccal cusp is noticeably longer than the palatal cusp.
- Buccal and palatal cusp tips are closer.
- Both the cusps are located well in the confines of the root outline.
- Buccal cusp tip is directly below the centre of the buccal root.
- Palatal cusp tip is in line with the palatal border of the palatal root.

*Outlines and surfaces:*

- Mesial marginal ridge (MMR) is located more occlusally as compared to distal marginal ridge (DMR).
- Cervical line is convex towards the occlusal. It is more convex on the mesial surface.
- Crest of curvature on the buccal surface is in the cervical third.
- Crest of curvature on the palatal surface is in the middle third.

**Mesial surface** has distinguishing features:

- A prominent concavity, **the canine fossa (CF)** is located at cervical to the mesial contact area. (below the cervical line)  
It accommodates the rounded disto-incisal angle of the canine.
- This crown concavity is in continuation with the concavity on the root.
- A well defined developmental groove, the **mesial marginal ridge groove (MMRG)** crosses the mesial marginal ridge (MMR) immediately lingual to the mesial contact area.  
It is continuous with the central groove (CG) on the occlusal surface.

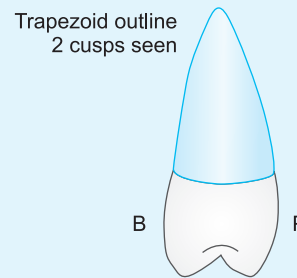


Fig. 4.6

**Crown:***Shape, cusp tips, and cusps:*

- The proximal surface has same shape.
- Two cusps are seen from this aspect. The buccal and palatal cusp tips are almost at same level.
- Buccal and palatal cusp tips are more apart.
- Same as that of first premolar.

*Outlines and surfaces:*

- Same as first premolar.
- Same as first premolar.
- Same as first premolar.
- There is **no concavity** on the mesial surface of the crown.
- The depression is present on the mesial surface of the root.
- There is no MMRG present.

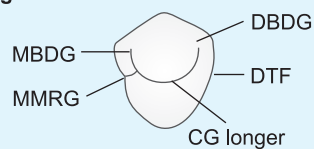
(Contd.)

*Maxillary first premolar***Root:**

- The root is **bifurcated** in the apical third or half its length with **one buccal** and **one palatal** root.
- On the mesial surface of the root trunk there is a deep developmental depression which is in continuation with the canine fossa.
- On the distal surface of the root trunk the depression is shallow.

*Maxillary second premolar (Contd.)***Root:**

- It has a **single root** which may be longer than the root of the first premolar.
- On the mesial surface the depression is shallow.
- On the distal surface the depression is deeper.

**Occlusal aspect****Hexagonal outline****Fig. 4.7***Shape, surface, outline, and ridges:*

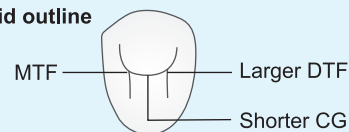
- Occlusal surface has **hexagonal** outline.
- The outline is asymmetrical.
- The six sides are the mesiobuccal (MB), mesial (M), mesiopalatal (MP), distobuccal (DB), distal (D), and distopalatal (DP).
- The occlusal surface consists of B and P cusps, B and P triangular ridges, M and D marginal ridges, triangular fossa, pits, and central groove (CG).
- The angle formed by the mesiobuccal cusp ridge and the MMR approaches a right angle.
- The angle formed by the distobuccal cusp ridge and the DMR is an acute angle.
- The MMR is shorter than the DMR.
- Buccal triangular ridge (BTR) of the B cusp is prominent and arises near the centre of the CG and ends at the tip of the B cusp.
- Lingual/palatal triangular ridge (PTR) extends from the P cusp tip to the CG.
- BTR and PTR join to form a transverse ridge.

*Fossa:*

- Mesial and distal triangular fossa (MTF and DTF) are triangular depressions closer to the marginal ridges.

*Grooves and pits*

- Occlusal surface of the first premolar **has fewer supplemental grooves**.
- A well-defined CG divides the occlusal surface evenly buccolingually.
- The length of the **CG is longer** as compared to that of second premolar.

**Ovoid outline****Fig. 4.8***Shape, surface, outline, and ridges:*

- Occlusal surface has rounded or oval outline.
- The outline is symmetrical.
- It is same as that of first premolar.
- The angle formed by the mesiobuccal cusp ridge and MMR is an obtuse angle.
- The angle formed by the distobuccal cusp ridge and the DMR is not an acute angle.
- It is same as that of first premolar.
- Buccal triangular ridge (BTR) is less prominent.
- It is same as that of first premolar.
- It is same as that of first premolar.

*Fossa:*

- Mesial and distal triangular fossae are triangular depressions away from the marginal ridge.

*Grooves and pits*

- Occlusal surface **has multiple supplemental grooves** radiating from the CG hence it appears **wrinkled**.
- Same as in first premolar.
- The length of the **CG is shorter**.

(Contd.)

*Maxillary first premolar*

- The CG extends from distal pit to mesial pit where it joins the MMRG.
- M and D pits are closer to the marginal ridges.
- Mesial pit is the point of union of three developmental grooves: (1) MMRG, (2) Mesiobuccal developmental groove (MBDG), (3) CG.
- Distal pit is the point of union of two developmental grooves: (1) distobuccal developmental groove (DBDG), (2) central groove (CG).

*Maxillary second premolar (Contd.)*

- The CG extends from mesial pit to distal pit.
- M and D pits are farther from marginal ridges.

**Q 2. Describe the morphology of mandibular first premolar.***(May 2007)***Ans. Introduction**

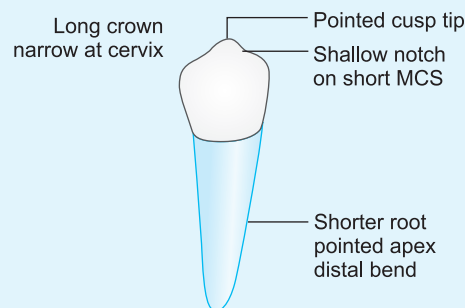
- Mandibular premolars are four in number two on either side of the midline in the lower arch.
- The first premolar has a large buccal cusp, which is long and well-formed with a small non-functioning lingual cusp.
- It has many of the characteristics of a small canine.
- It is smaller than the second premolar.

**Eruption**

It erupts between the age of 10–12 years.

**Numbering System**

- Palmer  $\frac{4}{4}$
- Universal R - # 28, L - # 21
- FDI R - # 44, L - # 34

*Mandibular first premolar from all aspects***Buccal aspect****Fig. 4.9****Crown:**

*Shape, size, and surface:*

- From this aspect the form of the crown is nearly symmetrical bilaterally.
- The crown is roughly trapezoid in shape.
- The crown is long and narrow at cervix.

*(Contd.)*

*Mandibular first premolar from all aspects (Contd.)**Outlines and cusp tip:*

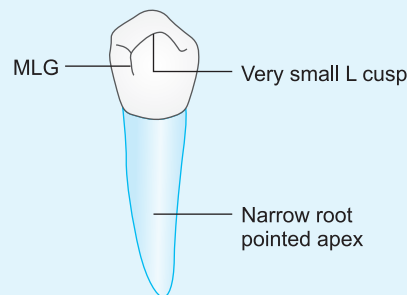
- The buccal surface is more convex than in maxillary premolars especially at cervical and middle-thirds.
- The buccal ridge is prominent with developmental depressions on either side of the buccal ridge.
- The crown tapers from contact area to the cervix.
- The mesial outline (M) is straight or slightly concave from cervical line to the mesial contact area.
- The distal outline (D) is slightly concave from the cervical line to the distal contact area.
- The mesial cusp slope (**MCS**) is shorter than the distal cusp slope (DCS). Both the cusp slopes form an acute angle at the cusp tip.
- There is a shallow notch on the mesial cusp slope.
- **Buccal cusp tip** is long and pointed and located a little mesial to the root axis.
- Cervical line slightly convex towards the root.

*Contact areas:*

- Mesial contact area is more cervical than the distal contact area (This is an exception along with deciduous maxillary canine.)

**Root**

- It has a pointed apex and a distal bend in the apical third.
- Some mandibular first premolars have slight distal tilt of the crown on the root.

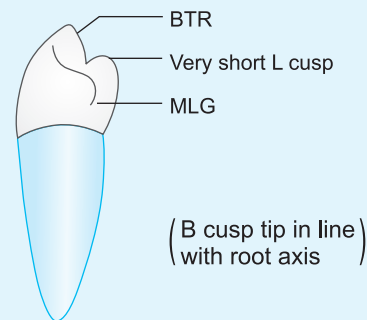
**Lingual aspect****Fig. 4.10****Crown:***Shape, size, surface, and cusp:*

- The crown is narrower on the lingual aspect.
- The major portion of the crown is made-up of the middle buccal lobe.
- The cervical portion of the crown lingually is narrow, and convex with concavities between the cervical line and the contact areas on the lingual portion of the mesial and distal surfaces.
- The contact areas and marginal ridges are pronounced and extend above the narrow cervical portion of crown.
- **Lingual cusp** is very small, pointed and non-functional.
- Lingual (L) cusp tip is in line with the buccal triangular ridge.
- Because of the smaller lingual cusp much of the buccal profile and occlusal surface may be seen from this aspect.
- Occlusal surface slopes sharply lingually in cervical direction, down to the short lingual cusp. Most of the occlusal surface of the tooth is therefore seen from this aspect.

(Contd.)

*Mandibular first premolar from all aspects (Contd.)***Root:**

- A characteristic of the lingual surface is the **mesiolingual developmental groove (MLG)**.
- It separates the mesial marginal ridge (MMR) from the mesial slope of the lingual cusp.
- The root tapers from cervix to a pointed apex.
- The root is much narrower on the lingual side due to which the developmental depressions on the root are seen on the mesial and distal surfaces.
- Mesial surface of the root has a deep developmental groove present.

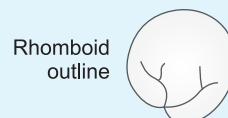
**Proximal aspect (M)****Fig. 4.11****Crown:***Shape and size:**Outlines and the cusps:*

- From this aspect, the **shape** of the crown is **rhomboid** which is characteristic of all the mandibular posterior teeth.
- The **buccal outline** of the crown from this aspect is prominently curved from the cervical line to the tip of the buccal cusp. The crest of curvature is at the junction of cervical and middle third **more towards** middle third.
- The **lingual outline** of the crown is a curved outline of less convexity than that of the buccal surface.
- The crest of curvature is in the middle third of the crown, which is outside the confines of the root. The curvature ends at the tip of the lingual cusp.
- Cervical line curvature is more on the mesial surface than the distal surface.
- The **lingual tilt** of the crown over the root is more as compared to that of the crown of second premolar.
- Occlusal plane is tilted lingually.
- **Mesial marginal ridge (MMR)** is more cervical as compared to **distal marginal ridge (DMR)** because it inclines (slopes) at 45° towards the cervix and is **parallel to the long, prominent buccal triangular ridge (BTR)**.
- Distal marginal ridge (DMR) is **horizontal** and more occlusal to the MMR and is confluent with the lingual cusp slope.
- The lingual triangular ridge (LTR) is short and horizontal.
- Mesiolingual developmental groove (MLG) is present between MMR and Mesial slope of the lingual cusp (from mesial aspect).
- The **buccal cusp tip** is in line with the root axis.
- The lingual cusp tip is in line with the lingual surface of the root.
- The lingual cusp is shorter than the buccal cusp by more than one-third of the total crown length.

*(Contd.)*

*Mandibular first premolar from all aspects (Contd.)*

- Contact area:**
- Mesial contact area is in line with the buccal cusp tip.
  - Distal contact area is broader.
- Root:**
- The root tapers evenly from the cervix to a pointed apex which is in line with the buccal cusp tip.
  - Root depressions are present on both mesial and distal root surfaces.

**Occlusal aspect****Fig. 4.12**

- Shape, size, and surface:**
- Both mandibular premolars exhibit more variations in form occlusally as compared to maxillary premolars.
  - Crown outline is roughly **diamond shaped** and similar to incisal aspect of mandibular canine and is asymmetrical.
  - Crown converges towards lingual.
- Outlines:**
- Mesial cusp slope is shorter than the distal cusp slope.
  - Mesial outline is flat or less curved.
  - Distal outline is more curved.
  - MMR is shorter and at an acute angle to the mesial cusp slope
  - Distal marginal ridge (DMR) is longer and at right angles to the distal cusp slope.
- Contact areas:**
- Mesial and distal contact areas are broad, distal being broader of the two.
- Ridges:**
- Middle lobe of the buccal cusp makes up for the major bulk of the crown.
  - **Buccal triangular ridge (BTR)** is more prominent, longer, and inclines **lingually from buccal** cusp tip to where it joins the short triangular ridge of the lingual cusp.
  - The two triangular ridges join to form a blunt transverse ridge, separating mesial and distal fossa.
- Fossa:**
- Mesial fossa (MF) is small, shallow, and linear with a mesial pit at its bottom. It contains mesio-buccal developmental groove (MBDG).
  - Distal fossa (DF) is large, deep and circular with a distal pit at its base.
- Groove:**
- Central groove is rarely present.
  - The mesiobuccal developmental groove (MBDG) runs buccolingually (BL) from mesial fossa and it is continuous with the mesiolingual developmental groove (MLG) as it passes over the mesiolingual surface.
  - A distal developmental groove (DDG) or a few supplemental grooves may extend from distal fossa.

**Q 3. Define and enumerate different type traits. Write in detail maxillary first premolar with endodontic anatomy.** (Dec. 2005)

**Ans.**

- A trait is a distinguishing characteristic.
- Type traits are the characteristics that differentiate the teeth within the same class, i.e. first premolars from second premolars.



### Type Traits of Maxillary Premolars

<i>First premolar</i>	<i>Second premolar</i>
<ul style="list-style-type: none"> <li>• Mesial cusp slope is longer than the distal cusp slope.</li> <li>• From proximal view the lingual cusp shorter than the buccal cusp and the cusp tips are closer.</li> <li>• Occlusal outline is sharp and hexagonal. Occlusal outline is asymmetrical.</li> <li>• On occlusal surface, the central groove is longer as compared to that on second premolar.</li> <li>• Occlusal surface is not wrinkled.</li> <li>• More often it has two roots.</li> <li>• Mesial crown and root depressions and mesial marginal ridge groove present.</li> </ul>	<ul style="list-style-type: none"> <li>• Mesial cusp slope is shorter than the distal cusp slope.</li> <li>• Both the cusps are almost of same height and the cusp tips are farther apart.</li> <li>• Occlusal outline is ovoid and is more symmetrical.</li> <li>• Central groove is shorter.</li> <li>• Occlusal surface is wrinkled.</li> <li>• It has a single root.</li> <li>• Mesial root depression only.</li> <li>• No MMRG.</li> </ul>

### Type Traits of Mandibular Premolars

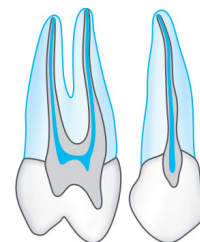
<i>First premolar</i>	<i>Second premolar</i>
<ul style="list-style-type: none"> <li>• The buccal cusp tip is more pointed.</li> <li>• The lingual cusp is very small and nonfunctional.</li> <li>• MMR is parallel to triangular ridge of buccal cusp.</li> <li>• The mesial marginal ridge (MMR) is more cervical as compared to distal marginal ridge (DMR).</li> <li>• Root depressions present on both mesial and distal surfaces.</li> <li>• From occlusal view the crown is diamond shaped.</li> <li>• There is presence of mesiolingual groove, separating the mesial marginal ridge from the lingual cusp.</li> </ul>	<ul style="list-style-type: none"> <li>• The buccal cusp tip is less pointed.</li> <li>• In two cusp types the lingual cusp is longer as compared to that of first premolar and the lingual cusp tip is towards the mesial.</li> <li>• In three cusp types there are two lingual cusps the mesiolingual cusp is larger than the distolingual cusp.</li> <li>• The MMR is horizontal and more occlusally placed. The DMR is more cervically placed.</li> <li>• Root depression present only on distal surface.</li> <li>• The crown has more of square or round shape.</li> <li>• Mesiolingual groove is absent.</li> </ul>

*(Detail description of maxillary first premolar is in Ans. 4)*

- Endodontic anatomy of maxillary first premolar:  
*Pulp chamber:*
  - is narrow from buccal view and wider from proximal view.
  - Roof of the pulp chamber is coronal to the cervical line and floor is below the cervical line.
  - The pulp chamber does not constrict much near the cervical part as there are two separate roots and two canals.
  - One pulp horn is present under each cusp.
  - Buccal pulp horn is more prominent.
- Cross-section at the cervical level shows characteristic **kidney-shaped** outline because of indentation due to presence of mesial developmental groove.

### Root and Root Canals

- The two well-formed roots divide in the middle third into buccal and lingual roots.
- A small percentage of teeth may have three roots.
- 40% of teeth have one root with two canals.
- There is possibility of roots having three canals, with one canal in the lingual root and two canals in the buccal root.
- Lingual canal is larger of the two canals.



**Fig. 4.13:** Maxillary first premolar

### Q 4. Describe morphology of maxillary first premolar and chronology.

(Dec. 2005, May 2009, 2014, 2015, June 2013)

**Discuss chronology, odontometric data and morphology of maxillary first premolar in detail.**  
(Nov. 2015)

#### Ans. Introduction

- Premolars are eight in number. They succeed the deciduous molars.
- They are anterior to molars and present in permanent dentition only.
- They form a transition from anterior to posterior teeth.

### Eruption

- It erupts between 10–11 years of age.

### Numbering System

Palmer	<u>4</u>
Universal	# 5
FDI	# 14

### Chronological Data

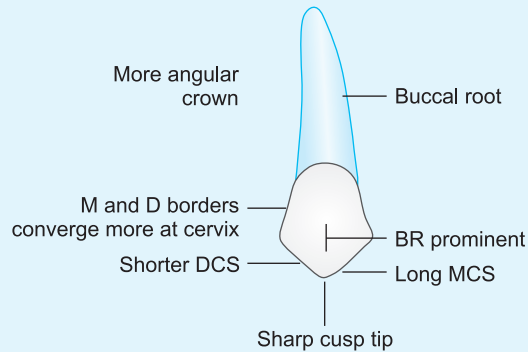
Initiation of calcification	1½–1¾ years
Completion of enamel	5–6 years
Eruption	10–11 years
Completion of root	12–13 years

#### Odontometric data

Length of crown	8.5 mm
Length of root	14.0 mm
Mesiodistal width of crown	7.0 mm
Mesiodistal width of crown at cervix	5.0 mm
Labiolingual width of crown	9.0 mm
Labiolingual width at cervix	8.0 mm
Curvature of cervical line on mesial	1.0 mm
On distal	0.0 mm

*Maxillary first premolar from each aspect*

**Buccal aspect (B)**



**Fig. 4.14**

**Crown:**

*Shape, size, and surface:*

- The crown has pentagon/trapezoid shape. It is more angular with buccal line angles more prominent. It has the widest crown of all the premolars.
- The crown is longer than that of the second premolar.
- Buccal surface is convex with a **prominent buccal ridge (BR)**.
- Mesial and distal to the buccal ridge are the developmental depressions.

*Outlines:*

- The mesial (M) and distal (D) outlines of the crown converge towards the cervix.
- Mesial outline is slightly concave from the cervical line to the contact point whereas the distal outline is almost straight.
- The buccal cusp tip is long and pointed. The mesial and distal cusp slopes meet at right angles.
- Location of buccal cusp tip is towards distal to the vertical axis line with a longer mesial cusp slope and a shorter distal cusp slope.
- Cervical line is convex towards the apex.

*Contact point:*

- The mesial contact point lies at the junction of occlusal and middle third and it is narrower as compared to the distal contact point.
- The distal contact point lies in the middle third of the crown and slightly cervical to the mesial contact point.
- Even so, the contact areas are more nearly at same level than those found on anterior teeth.

**Root:**

- The root tapers from cervix to the apex.
- The apical end of the root bends distally or may be straight.

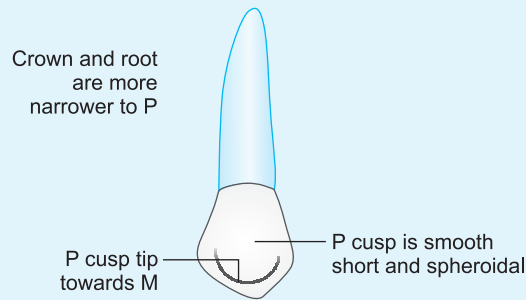
**Palatal aspect (P)**

**Crown:**

*Size, shape, and cusp:*

- On the palatal side the crown of the first premolar is more narrower than that of the second premolar.
- The tip of the unworn cusp is pointed and placed mesially.
- Palatal cusp is shorter, smooth, and spheroidal.
- Because the palatal cusp is narrower, part of mesial, and distal surfaces of crown and root are seen from this aspect.
- Because the palatal cusp is shorter the cusp tips and cusp slopes of both the cusps are seen from this aspect.

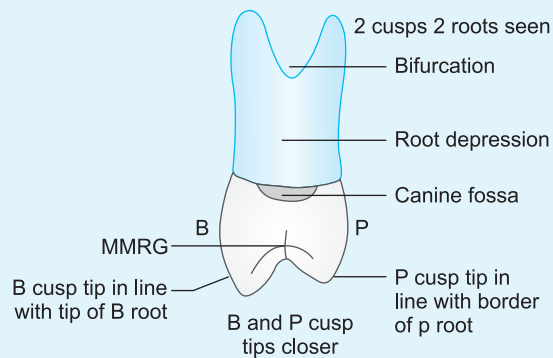
(Contd.)

*Maxillary first premolar from each aspect (Contd.)***Fig. 4.15****Outlines:**

- From this aspect the gross outline of the crown is reverse of the gross outline of the buccal aspect.
- Mesial and distal outline of the palatal cusp are convex and straighten at cervix, they continue with mesial and distal cusp slopes.

**Root:**

- The palatal root of two roots is smooth and convex.
- The apex of palatal root is more blunt compared to buccal root apex.

**Proximal aspect****Fig. 4.16****Crown:***Shape, cusp tip, and cusps:*

- Proximal surface has trapezoid shape. Longest uneven side towards cervical and shorter towards occlusal.
- 2 cusps are seen from this aspect. The buccal cusp is noticeably longer than the palatal cusp.
- Both the cusp tips are closer and located well in the confines of the root outline.
- Buccal cusp tip is directly below the centre of the buccal root.
- Palatal cusp tip is in line with the palatal border of the palatal root.
- Mesial marginal ridge (MMR) is located more occlusally as compared to the distal marginal ridge (DMR).
- Cervical line is convex towards the occlusal outline. It is more convex on the mesial surface.
- Crest of curvature on the buccal surface is in the cervical third.
- Crest of curvature on the palatal surface is in the middle third.

*Outlines and surfaces:**(Contd.)*

*Maxillary first premolar from each aspect (Contd.)*

**Mesial surface has distinguishing features:**

- A prominent concavity the canine fossa (CF) on the crown is located cervical to the mesial contact area. This concavity is in continuation with the concavity on the root surface.
- A well-defined developmental groove, the mesial marginal ridge groove (MMRG) crosses the mesial marginal ridge immediately lingual to mesial contact area. It is continuous with the central groove on occlusal surface.
- Mesial contact area is broad and at the junction of occlusal and middle third and buccally placed.

**Distal surface:**

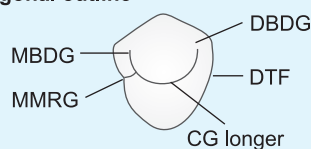
- It does not have the concavity on the crown and the marginal groove.
- Distal contact area is broader and more buccally placed.

**Root:**

- The root is bifurcated in the apical third with one buccal and one palatal root.
- On the mesial surface of the root trunk is a deep depression which is in continuation with the canine fossa.
- On the distal surface the depression is shallow.

**Occlusal aspect**

**Hexagonal outline**



**Fig. 4.17**

**Crown:**

*Shape:*

- Occlusal surface has hexagonal outline.
- The six sides are the mesiobuccal (MB), mesial (M), mesiolingual (ML), distobuccal (DB), distal (D) and distolingual (DL).

*Outline and surface:*

- The occlusal surface consists of buccal and palatal cusps, buccal, and palatal triangular ridges (BTR and PTR), mesial, and distal marginal ridges (MMR and DMR), triangular fossa (TF), pit, and central groove (CG).
- The angle formed by the mesiobuccal cusp ridge and mesial marginal ridge approaches a right angle. The angle formed by the distobuccal cusp ridge and the distal marginal ridge is an acute angle. The mesial marginal ridge is shorter than the distal marginal ridge.
- Buccal triangular ridge of the buccal cusp is prominent and arises near the centre of the central groove and ends at the tip of the buccal cusp.
- Palatal triangular ridge (PTR) extends from the palatal cusp tip to the central groove.
- The buccal and palatal triangular ridges join to form a transverse ridge.
- **Fossa:** Mesial and distal triangular fossa are triangular depressions closer to the marginal ridges.
- **Grooves:** Occlusal surface of the first premolar has fewer supplemental grooves. A well-defined central developmental groove divides the occlusal surface evenly buccopalatally (BP).
- The length of the central groove is longer as compared to that of the second premolar.

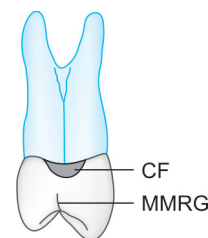
(Contd.)

*Maxillary first premolar from each aspect (Contd.)*

- The central groove extends from distal pit to mesial pit where it joins the mesial marginal ridge groove (MMRG).
  - Two collateral developmental grooves join the CG inside the MMR and the DMR. These are the MBDG and the DBDG.
  - Junction of these grooves is named as mesial and distal pits.
  - **Pit:** Mesial and distal pits are closer to the marginal ridges. Mesial pit is the point of union of three primary developmental grooves.
    - i. Mesial marginal ridge groove (MMRD)
    - ii. Mesiobuccal developmental groove (MBDG), and
    - iii. Central groove (CG).
- The distal pit is the point of union of two developmental grooves.
- i. Distobuccal developmental groove (DBDG), and
  - ii. Central groove (CG).

**SAQs (3 Marks each)****Q 1. Describe arch traits of premolars.***(Oct. 2003, Nov. 2014)***Mention morphological differences between maxillary and mandibular premolars. (Nov. 10)****Ans.** Same as LAQ Q.1.**Q 2. What is Canine fossa on tooth surface?***(June 2004)***Ans. CANINE FOSSA (CF)**

- It is a small concavity present on the mesial surface of the crown of the maxillary first premolar just below the cervical line to accommodate the rounded distoincisor angle of the canine.
- It is a mesial developmental depression on the mesial surface of the maxillary first premolar where distal rounded surface of the canine rests. It is cervical to the mesial contact area.
- It is believed to be produced (formed) due to the pressure of the distal aspect of the maxillary canine as it develops earlier than the first premolar.

**Fig. 4.18****Q 3. Discuss about mesial aspect of maxillary first premolar.***(May 2007)***Ans.**

- Mesial surface of maxillary first premolar is trapezoid in shape.
- Mesial marginal ridge is more occlusal as compared to distal marginal ridge.
- Cervical line is more convex towards the occlusal as compared to the cervical line on the distal aspect.
- Crest of curvature on the buccal surface is in the cervical third.
- Crest of curvature on the lingual surface is in the middle third.
- A prominent concavity, the **canine fossa** is present on the crown just below the cervical line.

This concavity is in continuation with the concavity on the mesial surface of the root trunk.

- A well-defined developmental groove, the mesial marginal ridge groove (MMRG) crosses the mesial marginal ridge immediately lingual to the mesial contact area.

It is continuous with the central groove on the occlusal surface.

**Q 4. Describe the type traits of mandibular premolars.****Ans.**

<i>Mandibular first premolar</i>	<i>Mandibular second premolar</i>
<ul style="list-style-type: none"> <li>It is smaller in size than the second premolar.</li> </ul>	<ul style="list-style-type: none"> <li>It is larger than the first premolar.</li> </ul>
Buccal aspect	
<ul style="list-style-type: none"> <li>Crown is longer and narrower at cervix.</li> <li>Cusp tip is pointed with steep cusp slopes.</li> <li>Buccal ridge is more prominent.</li> </ul>	<ul style="list-style-type: none"> <li>Crown is shorter and is wider at cervix.</li> <li>Cusp tip less pointed and cusp slopes meet at an obtuse angle.</li> <li>Buccal ridge is less prominent.</li> </ul>
Lingual aspect	
<ul style="list-style-type: none"> <li>The lingual cusp is small and nonfunctional</li> <li>One lingual cusp.</li> <li>Mesiolingual developmental groove separates the mesial marginal ridge from the lingual cusp.</li> </ul>	<ul style="list-style-type: none"> <li>The lingual cusp is longer and functional.</li> <li>One or two lingual cusps.</li> <li>Lingual groove separates the two unequal lingual cusps in 3-cusp type premolar.</li> <li>No groove in two-cusp type premolar.</li> </ul>
Proximal aspect	
<ul style="list-style-type: none"> <li>The lingual tilt of the crown is much more.</li> <li>The mesial marginal ridge slopes cervically therefore it is at a lower level than the distal marginal ridge.</li> <li>Depression present on both M and D surfaces of root.</li> </ul>	<ul style="list-style-type: none"> <li>The lingual tilt is less.</li> <li>The mesial marginal ridge is horizontal and more occlusally placed than the distal marginal ridge.</li> <li>Depression present only on the distal surface of the root.</li> </ul>
Occlusal aspect	
<ul style="list-style-type: none"> <li>Outline of the crown is diamond shaped.</li> </ul>	<ul style="list-style-type: none"> <li>In two-cusp type the crown outline is rounded or ovoid.</li> <li>In three-cusp type crown outline is more or less square.</li> </ul>

**Q 5. Describe the occlusal surface of mandibular second premolar?****Ans.**

- Mandibular second premolars are of two types.  
Two-cusp type, having one buccal and one lingual cusp.  
Three-cusp type, having one buccal and two lingual cusps.
- In **two-cusp** type the crown outline is more or less rounded or oval. The crown converges lingual to the mesiobuccal and distobuccal cusp ridges.  
The lingual cusp is smaller than the buccal cusp but larger than the lingual cusp on the first premolar.
- In the **three-cusp** type, the crown outline is more or less square lingual to the mesiobuccal and distobuccal cusp ridges due to the presence of two lingual cusps, which are uneven in size and smaller than the buccal cusp and are separated by a lingual groove. Mesiolingual cusp is longer and wider than the distolingual cusp.

### Ridges, Grooves and Fossa

- **Two-cusp type.**

- The triangular **ridge** of the buccal cusp is long and wide. It joins the not so prominent triangular ridge of the lingual cusp to form a transverse ridge.
- The mesial **fossa** is small and circular. The distal fossa is large and circular.

In two-cusp type more supplemental grooves present.

In two-cusp type of mandibular second premolar, two types of groove pattern is seen.

#### *U-type* (Fig. 4.19A)

The central groove from mesial to distal pit is slightly curved towards lingual.

The central groove, along with the mesiobuccal developmental groove (MBDG) and the distobuccal developmental groove (DBDG) forms a U-shaped groove which is open and directed towards the buccal side.

#### *H-type* (Fig. 4.19B)

The central groove is straight and short from M to D pit. The CG along with the MBDG, MLDG, DBDG, DLDG forms the H-shaped groove pattern.

#### *Three-Cusp Type* (Fig. 4.19C)

- Each cusp has well-formed **triangular ridges** separated by deep developmental grooves. These grooves converge in a central pit (CP) and form a Y-shape, on the occlusal surface.
- There is no transverse ridge.
- The **central pit (CP)** located midway between the buccal cusp ridge and the lingual margin of the occlusal surface and slightly distal to the central point between the MMR and DMR.
- **Mesial fossa** is small and triangular. Distal fossa is smaller and also triangular. Distal fossa appears to be in the outer edge of the central fossa.

In the **three-cusp** type mandibular second premolar, the groove pattern is **Y-type**.

- There is no central groove.
- The longer mesial groove extends in MB direction from the central pit (CP) and ends in the mesial triangular fossa (MTF).
- The shorter distal groove continues from the central pit in DB direction and ends in Distal triangular fossa (DTF).
- A lingual groove also unique to the three-cusp type, begins in the CP and extends lingually between the ML and DL cusps and on to the lingual surface.
- The three grooves together form a Y-shaped groove pattern.

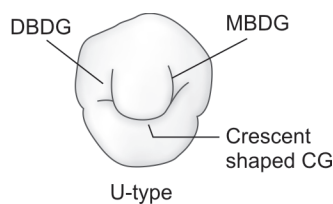


Fig. 4.19A

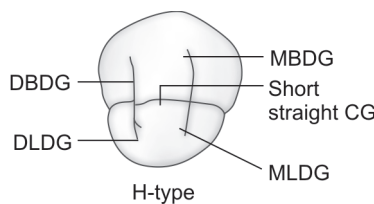


Fig. 4.19B

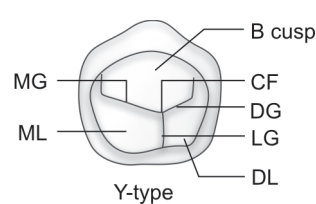


Fig. 4.19C



## MULTIPLE CHOICE QUESTIONS (MCQs)

1. The term premolar is used to designate any tooth in the permanent dentition of mammals that succeeds
  - a. A primary first molar
  - b. A primary second molar
  - c. Both a and b
  - d. None of the above
2. The maxillary right and left first premolars can be identified by the universal numbering system as
  - a. 4 and 11
  - b. 5 and 12
  - c. 14 and 24
  - d. 13 and 22
3. The facial or buccal surface of all premolars develop from
  - a. 2 facial lobes
  - b. 3 facial lobes
  - c. One lobe
  - d. None of the above
4. The only premolar with buccal crest of curvature located as far cervically as in the anterior teeth is
  - a. Maxillary first premolar
  - b. Mandibular first premolar
  - c. Mandibular second premolar
  - d. Maxillary second premolar
5. Permanent canines and all premolars have the mesial slope of the buccal cusp shorter than the distal cusp slope except
  - a. Mandibular first premolar
  - b. Maxillary first premolar
  - c. Maxillary second premolar
  - d. Mandibular second premolar
6. Usually premolars have two cusps one buccal and one lingual except one premolar which has two lingual cusps; that is
  - a. Maxillary second premolar
  - b. Mandibular first premolar
  - c. Mandibular second premolar
  - d. Maxillary first premolar
7. Mesial marginal ridges are more occlusal than distal marginal ridges which are more cervical except in
  - a. Mandibular first premolar
  - b. Mandibular second premolar
  - c. Maxillary first premolar
  - d. Maxillary second premolar
8. From the occlusal view the shape of the maxillary premolar crown is
  - a. Square
  - b. Round
  - c. Oblong
  - d. Rectangular
9. From the occlusal view mandibular second premolar crown is
  - a. Square
  - b. Oblong
  - c. Round
  - d. Triangular
  - e. Square or round
10. All premolar crowns are narrower on the lingual side than on the buccal side except
  - a. Mandibular second premolar (Y-shaped)
  - b. Mandibular first premolar
  - c. Maxillary first premolar
  - d. Maxillary second premolar
11. Lingual cusp tips are positioned off center to the mesial most often in
  - a. Maxillary premolars
  - b. Mandibular premolars
  - c. Both a and b
  - d. None of the above
12. The widest crown, buccal cusp long and pointed with M and D slopes meeting at right angles is common to
  - a. Maxillary first premolar
  - b. Maxillary second premolar
  - c. Mandibular first premolar
  - d. Mandibular second premolar

1-c, 2-b, 3-b, 4-b, 5-b, 6-c, 7-a, 8-c, 9-e, 10-a, 11-a, 12-a

- 13. The premolar commonly having two roots is**  
a. Maxillary first premolar  
b. Maxillary second premolar  
c. Mandibular first premolar  
d. Mandibular second premolar
- 14. Cross-section of maxillary first premolar at cemento-enamel junction is**  
a. Oval shaped  
b. Round shaped  
c. Kidney shaped  
d. Triangular shaped
- 15. In maxillary first premolar, the pulp horn extends further occlusally under the**  
a. Buccal cusp      b. Lingual cusp  
c. None              d. Both a and b
- 16. The lingual root of the two rooted maxillary first premolar is**  
a. Shorter than buccal root  
b. Equal to buccal root  
c. Longer than buccal root  
d. None of the above
- 17. The mesial marginal ridge groove and mesial concavity is present in**  
a. Maxillary first premolar  
b. Maxillary second premolar  
c. Mandibular first premolar  
d. Mandibular second premolar
- 18. The deepest mid root depression on the distal is common to**  
a. Maxillary first premolar  
b. Maxillary second premolar  
c. Mandibular second premolar  
d. Mandibular first molar
- 19. The only premolar with an obvious concavity or depression on the mesial surface of the crown and this depression continues onto the root is**  
a. Mandibular first premolar  
b. Maxillary first premolar  
c. Maxillary second premolar  
d. Mandibular second premolar
- 20. Pulp chamber floor in maxillary first premolar is at**  
a. Cervical level  
b. Below cervical level  
c. Above cervical level  
d. None of the above
- 21. The only premolar having very small, pointed, nonfunctional lingual cusp is**  
a. Maxillary first premolar  
b. Mandibular first premolar  
c. Mandibular second premolar  
d. Maxillary second premolar
- 22. The groove separating the mesial marginal ridge from the mesial slope of the small lingual cusp is the**  
a. Mesial marginal groove  
b. Mesiolingual groove  
c. Lingual groove  
d. Distal marginal groove
- 23. Mesial marginal ridge is more cervical, mesial half of lingual surface is like a canine and distal half is like a molar this is a unique feature of**  
a. Mandibular first premolar  
b. Maxillary first premolar  
c. Maxillary second premolar  
d. Mandibular second premolar
- 24. On the mandibular second premolar with two lingual cusps the mesiolingual and distolingual cusps are separated by**  
a. Mesiolingual groove  
b. Distolingual groove  
c. Lingual groove  
d. None of the above
- 25. The tip of the buccal cusp is in line with the root axis in (Proximal view)**  
a. Mandibular first premolar  
b. Second premolar  
c. Maxillary first premolar  
d. Maxillary second premolar

13-a, 14-c, 15-a, 16-a, 17-a, 18-b, 19-b, 20-b, 21-b, 22-b, 23-a, 24-c, 25-a

- 26. In cross-section of the tooth the classic indentation is present because of the mesial developmental groove in**
- Mandibular first premolar
  - Maxillary canine
  - Maxillary first premolar
  - Maxillary second premolar
- 27. The triangular ridge of the lingual cusp is in horizontal plane in**
- Mandibular second premolar with two lingual cusps
  - Mandibular second premolar with one lingual cusps
  - Mandibular first premolar
  - Maxillary first premolar
- 28. Because of the extreme lingual tilt of the crown of mandibular premolars, the tip of the lingual cusp**
- Is in line with the lingual surface of the root
  - Extends lingually beyond the lingual surface of the root
  - Placed buccally
  - Is in line with the root axis
- 29. Lingual tilt of the crowns is the characteristic of all the posterior teeth of**
- Maxillary arch
  - Mandibular arch
  - Both the arches
  - Neither arch
- 30. Premolars identified as #5 and #12 by universal numbering system are**
- Maxillary R and L first premolar
  - Maxillary R and L second premolar
  - Mandibular R and maxillary R second premolars
  - None of the above
- 31. By universal numbering system, maxillary R and L second premolar are**
- #4 and #13      b. #5 and #12
  - #28 and #21    d. #6 and #13
- 32. Buccolingual and mesiodistal dimension are more nearly equal and the occlusal surface more square in**
- Maxillary premolar
  - Mandibular premolar
  - Mandibular canine
  - Maxillary central incisor
- 33. The characteristic that differentiates maxillary first premolar from maxillary second premolar is**
- Mesial concavity cervical to contact area
  - Long buccal cusp
  - Mesial root depression, mesial marginal groove
  - All of above are correct
- 34. Premolar having canal that occasionally bifurcates at the apical third of the root is**
- Mandibular first premolar
  - Maxillary first premolar
  - Maxillary second premolar
  - Mandibular second premolar
- 35. Buccal and lingual pulpal projection or fins are present at the level of cemento-enamel junction and may show constriction at same level in**
- Maxillary first premolar
  - Maxillary second premolar
  - Mandibular first premolar
  - Mandibular second premolar
- 36. Wrinkled appearance of occlusal surface is common in**
- Maxillary 2nd premolar
  - Maxillary 1st premolar
  - Mandibular 1st premolar
  - Mandibular 2nd premolar
- 37. Maxillary first premolar erupts at the age of**
- 10–12                      b. 9–11
  - 8–10                        d. 7–9

26-c, 27-c, 28-a, 29-b, 30-a, 31-a, 32-b, 33-d, 34-c, 35-b, 36-a, 37-a

38. The first evidence of calcification of the maxillary first premolar takes place at the age of
- 2–3 years after birth
  - 3–4 years after birth
  - 1½ to 1¾ years after birth
  - After birth
39. The tooth which shows kidney-shaped outline in the cervical cross-section is
- Mandibular first premolar
  - Mandibular second premolar
  - Maxillary first premolar
  - Maxillary second premolar
40. A premolar having a well developed mesiolingual groove is
- Maxillary first premolar
  - Mandibular first premolar
  - Maxillary second premolar
  - Mandibular second premolar
41. The mandibular second premolar resembles mandibular first premolar from
- Buccal view
  - Lingual view
  - Occlusal view
  - All of the above
42. Maximum buccolingual dimension is found in
- Maxillary first premolar
  - Mandibular first premolar
  - Mandibular second premolar
  - All of them have same dimension
43. Maximum mesiodistal dimension is present in which premolar?
- Maxillary premolars
  - Mandibular first premolar
  - Mandibular second premolar
  - All of them have same dimension
44. The premolar which frequently has a central pit is
- Maxillary first premolar
  - Maxillary 2nd premolar
  - Mandibular 1st premolar
  - Mandibular 2nd premolar
45. In a longitudinal section of a premolar crown, the enamel is thickest in the
- Cervical third
  - Middle third
  - Occlusal third
  - Junction of cervical and middle third
46. In a mandibular arch, the greatest lingual inclination of the crown from its root is seen in
- Canine
  - First molar
  - First premolar
  - Central incisor
47. The teeth that erupts at 10–12 years of age is
- Permanent central incisor
  - Permanent first molar
  - Premolar
  - Permanent second molar
48. In the sequence of eruption of permanent dentition the maxillary canine usually follows
- Maxillary lateral incisor
  - Mandibular first premolar
  - Mandibular second premolar
  - Mandibular canine
49. The three cusp form is seen in
- Upper first premolar
  - Upper second premolars
  - Lower first premolar
  - Lower second premolar
50. The small and non-functional lingual cusp of mandibular first premolar is compared to
- The cusp of Carabelli
  - Cingulum of canine
  - Distal cusp of molars
  - None of the above
51. Which of the following premolars frequently has only one pulp horn?
- Maxillary first
  - Mandibular first
  - Maxillary second
  - Mandibular second

38-c, 39-c, 40-b, 41-a, 42-a, 43-d, 44-d, 45-c, 46-c, 47-c, 48-c, 49-d, 50-b, 51-b

- 52. In the mandibular arch the M and D contact points are at approximately same level in all teeth except the mandibular**
- a. Canine
  - b. First molar
  - c. First premolar
  - d. Lateral incisor
- 53. Lingual cusp is mesial in which maxillary premolars?**
- a. First premolar only
  - b. Second premolar only
  - c. Both first and second
  - d. Neither first or second

# The Permanent Molars

## LAQs (10 Marks)

**Q 1. Describe morphology of maxillary first molar.**

(June 2004)

**Write class and arch traits of molars. Describe in detail the morphology of maxillary first molar.**

(Second BDS) (Nov. 2010)

**Ans.** Class and arch traits of molars refer page 76.

### Morphology of Maxillary First Molar

#### Introduction

- The maxillary first molar is the largest tooth in the maxillary arch.
- It has four well-developed functioning cusps and one supplemental cusp of little practical use, the cusp of Carabelli.
- It has three well-developed and well separated roots.
- The crown of the tooth is wider buccopalatally (BP) than mesiodistally (MD).

#### Eruption

It erupts at around 6 years of age.

#### Numbering System

Palmer:	$\frac{6}{ }$
Universal:	# 3
FDI:	16

## Maxillary first molar from each aspect

## Buccal aspect

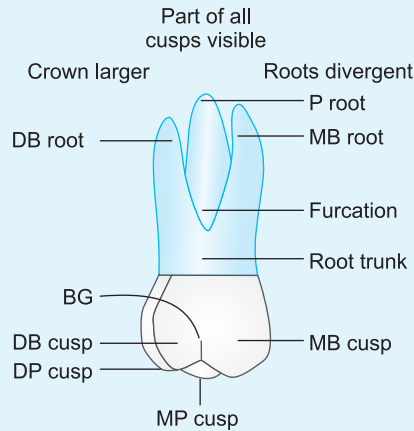


Fig. 5.1

**Crown:**

Shape, size, surface, cusps, and outlines:

- The crown is roughly trapezoidal with shorter cervical and longer occlusal sides representing the uneven sides. The crown is **wider mesiodistally (MD) than cervicoocclusally**.
- Crown is shorter from mesial (M) to distal (D).
- The crown tapers from contact area to the cervix.
- Mesial outline is straight from cervix to the contact point.
- Distal outline is convex.
- The cervical line has slight convexity towards the root.
- **The two buccal cusps** are separated by a **buccal groove (BG)**.
- It has four functional cusps. **All four** cusps mesiobuccal (MB), distobuccal (DB) and part of mesiopalatal (MP) and distopalatal (DP) are **seen from this aspect**. This is possible because of the obtuse character of the distobuccal line angle. This is possible because the two palatal cusps are offset to the distal in relation to the buccal cusps.
- The mesiobuccal cusp is wider than the distobuccal cusp. The distobuccal cusp is more pointed.
- Mesial contact area is at the junction of occlusal and middle third.

Contact area:

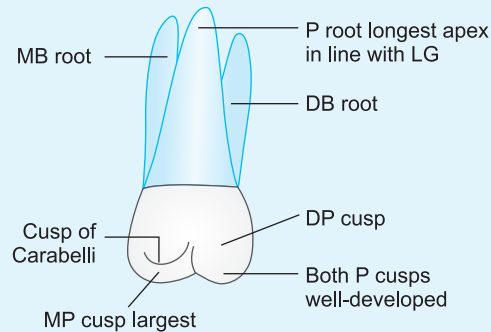
**Root:**

- Distal contact area is in the middle of the middle third.
- All the **three divergent** roots are seen from this aspect. The three roots are palatal root, which is longest, the mesiobuccal root and the distobuccal root.
- Root trunk is shorter (4 mm).
- Roots are about twice as long as the crown.
- The **palatal** root is longer than the mesiobuccal (MB) root. It is visible between the two buccal roots from this aspect, and the apex is located almost in line with the buccal groove (BG).
- Both mesiobuccal (MB) and distobuccal (DB) roots are nearly same length, both taper apically, mesiobuccal root apex is blunt and is in line with the tip of the MB cusp.
- The spread of the middle thirds of the two buccal roots is nearly as wide as the crown.

(Contd.)

*Maxillary first molar from each aspect (Contd.)*

- MB and DB roots bend in such a way that they look like handles on a pair of pliers.
- Often the MB and DB roots curve distally.
- A deep developmental groove is present on the root trunk from furcation area to the cervical line.

**Palatal/lingual aspect****Fig. 5.2****Crown:***Shape, size, and surface:*

- The shape is trapezoidal.
- The palatal surface is more convex.
- It is narrower in the cervical third.
- The M and D outline are similar except that distal outline is shorter and semicircular.
- The palatal developmental groove starts approximately in the centre of palatal surface mesiodistally, curves sharply to the distal as it extends between the two palatal cusps on to the occlusal surface.
- On the palatal surface of the mesio-palatal cusp a **fifth cusp, the cusp of carabelli** is present. It is mini cusp or tubercle. It is non-functioning. It is 2 mm short of mesio-palatal cusp tip. A groove normally separates the cusp of Carabelli from the cusp ridges of mesio-palatal cusp.
- From this aspect only 2 palatal cusps visible.
- **Mesio-palatal** cusp is much **larger**, and before the occlusal wear it is always the longest cusp. Its mesiodistal width is about three-fifths of the MD crown diameter. Distopalatal cusp making the remaining two-fifths.
- Mesio-palatal cusp slopes make an obtuse angle.
- Distopalatal cusp is spheroidal.

**Root:**

- All three roots are visible from this aspect.
- The **palatal root** is longest, conical and tapers in blunt round apex which is in line with the palatal groove.
- The palatal portion of the palatal trunk is continuous with the entire cervical portion of the crown palatally.
- Longitudinal depression is present on the palatal aspect of the root.
- The wide mesiodistal spread of the buccal roots is visible from this aspect.

*(Contd.)*



## Maxillary first molar from each aspect (Contd.)

## Proximal aspect

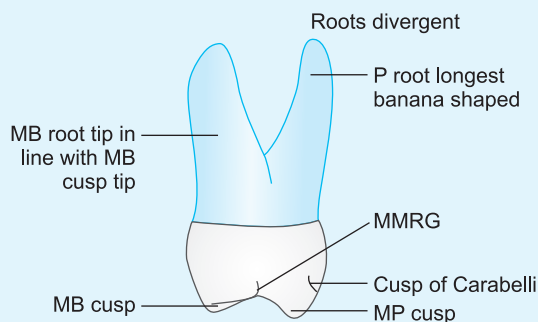


Fig. 5.3

**Crown:**

Shape, size, and surface:

Outline:

Cusps:

Contact area:

**Root:****Crown:**

Shape, size, and surface:

**Mesial aspect:**

- Shape is trapezoidal, wider at cervical and narrow at occlusal.
- Crown is shorter and wide buccopalatally.
- The height of contour on the buccal surface is in the cervical one-third and on the palatal surface it is in the middle of the crown.
- Cervical line is slightly convex above the contact area.
- Mesial marginal ridge is confluent with the cusp ridges of MB and ML cusps. It is concave, longer and more occlusally placed as compared to distal marginal ridge.
- From this aspect two cusps **mesiobuccal** and **mesiopalatal** are seen and **the fifth cusp, the cusp of carabelli 2–3 mm** below the tip of the mesio-palatal cusp is also seen.
- Mesial contact area is at the junction of middle and occlusal thirds and buccal to the centre of the crown buccopalatally.
- Roots are more divergent.
- From mesial aspect two roots are seen the mesiobuccal and the palatal root, the distobuccal root is hidden by the broader mesiobuccal root.
- **Mesiobuccal root** is broad **buccopalatally** and flattened on its mesial surface. It is shorter than the palatal root.
- The apex of the MB root is in line with the tip of the MB cusp.
- **MB root** has two **root canals**.
- From the buccal outline to the point of bifurcation, the width of the root on root trunk is approx two-thirds of the crown measurement BL at the cervix.
- The root trunk is 3 mm long.
- **Palatal root** is the longest, it is **banana-shaped and extends beyond** the crown palatally.

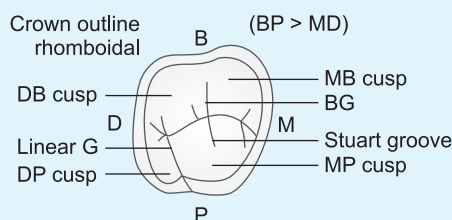
**Distal aspect:**

- Crown is narrower towards the distal and because of the rhomboid shape much of the buccal surface of the crown is seen from this aspect.
- Distal marginal ridge is more cervical compared to MMR. Cervical line is almost straight.
- **Tip of MB and MP cusps** are seen from this aspect.

(Contd.)

*Maxillary first molar from each aspect (Contd.)***Root:**

- **Distobuccal root** is shorter, narrower, and pointed therefore **mesiobuccal root is visible** from this aspect
- The root trunk is 5 mm long.
- (The length of the root trunk, from the cervical line to the point of bifurcation: on the mesial aspect is 3 mm, on the buccal aspect is 4 mm, and on the distal aspect is 5 mm.)

**Occlusal aspect****Fig. 5.4****Crown:***Shape, outline, and cusps:*

- From this aspect it has somewhat rhomboidal outline following the four major cusp ridges and the marginal ridges.
- Buccopalatal (BP) dimension is more than mesiodistal (MD) dimension.
- Crown tapers from mesial to distal.
- In maxillary first molar (only molar) where the palatal side may be wider as compared to the buccal.
- The four major cusps and one minor cusp present.
- The **mesiopalatal cusp** is the largest with a rounded cusp tip.
- **Distopalatal cusp** is the smallest and most variable.
- Mesiobuccal cusp is second largest with sharp cusp tip and slightly larger than the distobuccal cusp.
- The distobuccal cusp is the third largest with sharpest cusp tip.

**Fossa:**

- There are two major fossae and 2 minor fossae.
- The major fossa is the central fossa (CF) which is roughly triangular and mesial to the oblique ridge and the distal fossa (cigar fossa) which is linear and distal to and parallel to the oblique ridge.
- The central fossa has connecting sulci within its boundaries with developmental grooves at the deepest portion of these sulci (sulcate grooves).
- The two minor fossae are the mesial triangular fossa (MTF) and the distal triangular fossa (DTF) which are located just distal to and mesial to the MMR and the DMR.

**Ridge:**

- Each of the four cusps has at least one definite triangular ridge. The mesiopalatal (MP) cusp has two triangular ridges (few texts refer only one triangular ridge). The groove between the two triangular ridges of mesiopalatal cusp is called the **Stuart groove**. The mesial triangular ridge of mesiolingual/palatal cusp (MTRMP) joins the triangular ridge of mesiobuccal cusp (MB) to form a transverse ridge.

(Contd.)

*Maxillary first molar from each aspect (Contd.)*

The distal triangular ridge of mesiopalatal cusp (DTRMP) aligns with the triangular ridge of the distobuccal cusp (TRDB) to form a diagonal ridge called the **oblique ridge**. (OR)

Other texts refer to **DTRMP** by another name the distal cusp ridge of mesiopalatal cusp (DCRMP). Subsequently the OR is formed by the triangular ridge of distobuccal cusp and the **distal cusp ridge** of the mesiopalatal cusp (Refer page 399 Fig. 25.132).

- The oblique ridge is reduced in height in the centre of the occlusal surface being about at the level of the marginal ridges of the occlusal surfaces sometimes it is crossed by a developmental groove that partially joins the two major fossa by means of a shallow sulcate groove.
- The MMR and the DMR are irregular ridges confluent with the mesial and distal cusp ridges of the mesial and distal major cusps.
- The central pit is located at the centre of the central fossa.
- Mesial and distal pits are located at the bottom of the mesial and distal fossa.

*Pits:*

*Grooves:*

- There are **5 major developmental grooves**. Central groove (CG), buccal groove (BG), distal oblique groove (DOG), palatal groove (PG), sometimes the **transverse groove of the oblique ridge**, and the **fifth cusp developmental groove (CDG)**.
- **Central groove** extends in the mesial direction at an obtuse angle to buccal groove from the central pit (over the mesial transverse ridge) and ends in the mesial triangular fossa.
- A short developmental groove radiates from the central pit, extends distopalatally where it either crosses the oblique ridge and ends in the distal fossa or fades out before reaching the oblique ridge.

This part of the CG which extends over the oblique ridge is called the **transverse groove of the oblique ridge**, it is a shallow developmental groove.

- **Buccal groove** extends from the central pit in buccal direction on to the buccal surface.
- **Distal oblique groove** or **linear groove** or **distopalatal groove** extends obliquely and traverses the distal linear fossa to join the palatal developmental groove between the mesiopalatal and distopalatal cusps. It shows several supplemental grooves.

At distal pit it terminates into two branches which form the two sides of the distal triangular fossa (DTF).

- **Palatal developmental groove (PG)** separates the MP and DP cusps and extends on the palatal surface to terminate at the centre of the crown palatally below the palatal root.
- **Fifth cusp groove** outlines the fifth cusp (cusp of carabelli) it joins the palatal groove near its terminus.

The other grooves are:

- Distal marginal groove.
- Distobuccal triangular groove and distopalatal triangular groove.
- Mesial marginal groove.
- Mesiobuccal triangular groove and mesiopalatal triangular groove.

**Q 2. Describe morphology of maxillary second molar.**

(May 2002)

**Ans. Introduction**

- The maxillary second molar is the second largest tooth in the maxillary arch.
- It is similar in form to the first molar, but is generally smaller, especially in the distopalatal arc.
- The buccopalatal dimension is almost the same as the first molar but mesiodistally it is noticeably narrower.

**Eruption**

- It erupts at around 12 years of age.

**Numbering System**

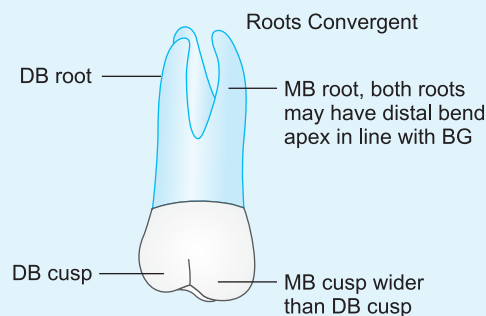
Palmer: 7

Universal: R # 2

L # 15

FDI: 17

L 27

*Maxillary second molar from each aspect***Buccal aspect****Fig. 5.5****Crown:***Shape, size, and surface:*

- The crown is roughly trapezoidal with shorter cervical and longer occlusal sides representing the parallel uneven sides.
- The crown is narrower mesiodistally shorter cervicoocclusally than the maxillary first molar.
- The crown tapers from contact area to cervix.
- The larger and wider mesiobuccal cusp is separated from the smaller and sharper distobuccal cusp by a buccal groove.
- Smaller DB cusp allows part of the distal marginal ridge and part of the DP cusp to be seen from this aspect.

*Contact areas:*

- Mesial contact area is at the junction of occlusal and middle third.
- Distal contact area is little cervical to the mesial contact area.

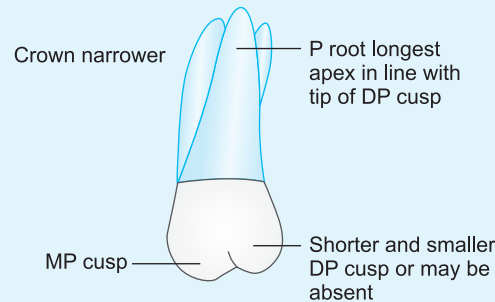
**Roots:**

- The **three roots** are less divergent and are seen from this aspect.

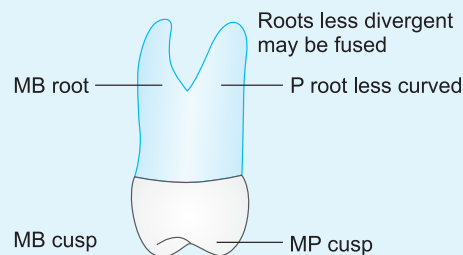
(Contd.)

*Maxillary second molar from each aspect (Contd.)*

- The buccal roots are of the same length. These roots are more nearly parallel and are inclined distally more than those of the maxillary first molar so that the end of the distobuccal root is slightly distal to the distal extremity of the crown.
- The apex of the MB root is on a line with the buccal groove of the crown instead of the tip of the MB cusp.
- The root trunk is longer. The chances of fusion of roots is greater.

**Palatal/lingual aspect****Fig. 5.6****Crown:***Shape, size, surface, and cusps:*

- The shape is trapezoidal.
- The palatal surface is more convex.
- The palatal surface is narrower in the cervical third because of the taper of the crown to join the single palatal root.
- The mesial and distal outlines are same as on the buccal surface except that distal outline is shorter and semi-circular.
- Due to shorter and smaller distopalatal cusp or nonexistent distopalatal cusp, the crown on this aspect is less wide.
- **Distopalatal** cusp is small or absent.
- **The fifth** cusp is absent.
- The distobuccal cusp is seen through the sulcus between the MP and DP cusps.
- In the 4 cusp type of maxillary second molar, MP and DP cusps are separated by a palatal groove (PG).
- The **palatal root** is the longest and has a longitudinal depression on the palatal aspect.
- It tapers in blunt round apex.
- The palatal root apex is in line with the tip of the distopalatal cusp.
- **Buccal roots** are more parallel and have a distal bend.

**Proximal aspect***Mesial aspect:***Fig. 5.7**

(Contd.)

*Maxillary second molar from each aspect (Contd.)***Crown :***Shape, size surface, and cusps:*

- Shape is trapezoidal, wider at cervix and narrow towards occlusal.
- Crown is **shorter**.
- **Buccopalatally dimension** is same as that of first molar.
- From this aspect MB and MP cusps are seen **cusp of Carabelli is absent**.

*Outline:*

- The height of contour on the buccal surface is in cervical third and on palatal surface it is in the middle of the crown.
- The mesial marginal ridge (MMR) is concave, longer, and more occlusal.
- The mesial marginal ridge groove (MMRG) is less common.

*Contact area:*

- The mesial contact area is at the junction of middle occlusal third, and buccal to the centre of the crown buccopalatally.

**Root:**

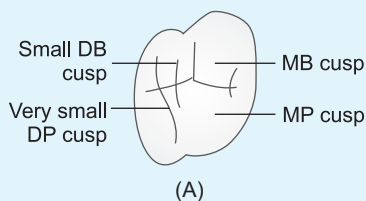
- The roots are less spread being within the confines of the crown buccopalatally.
- The roots are shorter and may be fused.
- Mesio Buccal root has a single canal.
- Palatal root is less curved or may be straight.

*Shape, size, and surface:***Distal aspect:**

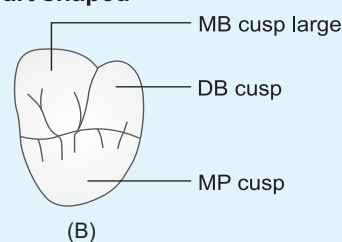
- Crown is narrower towards the distal, more of the buccal surface is seen.
- Distal marginal ridge is more cervical compared to MMR.
- Cervical line is almost straight.

**Root :**

- Distobuccal root is shorter and narrower therefore MB root visible from this aspect.
- The palatal root is less curved and the apex is in line with the tip of the DL cusp.

**Occlusal aspect****Crown outline  
accentuated rhomboid**

(A)

**Crown outline  
heart shaped**

(B)

**Figs 5.8A and B****Crown:***Shape, outlines, and cusps:*

- There are two types of occlusal surfaces.
- The **rhomboid type** of second maxillary molar is more frequent.
- It has **four cusps**.
- It appears like a **twisted parallelogram** or **accentuated rhomboid**, rhomboid outline is more extreme with palatal portion twisted distally more acute angle on MB corner due to prominent MB cervical ridge.
- The **heart-shaped** type of second maxillary molar has **three-cusps**. The **disto-palatal cusp is absent**.
- The **occlusal surface** is narrower mesiodistally than the first molar.
- The crown tapers from mesial to distal.

(Contd.)

*Maxillary second molar from each aspect (Contd.)*

	<ul style="list-style-type: none"> <li>• There is more taper from buccal to palatal due to smaller DL cusp or due to absence of DP cusp.</li> <li>• The MB and DP acute line angles are smaller.</li> <li>• MP and DB obtuse line angles are wider.</li> <li>• MB and MP cusps are well-developed and as large as in first molar whereas DB and DP cusps are less developed.</li> <li>• MB cusp is much larger than the DB cusp.</li> <li>• MB cervical ridge is more prominent.</li> </ul>
<i>Fossae:</i>	<ul style="list-style-type: none"> <li>• In the <b>4-cusp type</b> there are 4 fossae. 2 major fossae, the central fossa, and the distal fossa.</li> <li>• 2 minor fossae, the mesial, and distal triangular fossae.</li> <li>• In the <b>3-cusp type</b>, there are 3 fossae. The distal fossa is absent.</li> </ul>
<i>Ridges:</i>	<ul style="list-style-type: none"> <li>• The <b>oblique ridge</b> is shorter and less prominent.</li> <li>• <b>MMR</b> is more occlusally placed than the DMR.</li> <li>• DMR which is more longer and more cervically placed.</li> <li>• In 3-cusp type there is no oblique ridge or may be faint.</li> </ul>
<i>Pits and grooves:</i>	<ul style="list-style-type: none"> <li>• There are 3 pits.</li> <li>• Central pit, mesial pit and distal pit.</li> <li>• <b>Central groove</b> extends from central pit to mesial triangular fossa.</li> <li>• The <b>buccal groove</b> extends from the central pit in the buccal direction between the MB and DB cusps onto the buccal surface.</li> <li>• Distal oblique groove, and palatal groove are absent in the 3-cusp type of second molar.</li> <li>• It 4-cusp type distal oblique groove, palatal groove present.</li> <li>• Groove pattern is similar to that of first molar, but is more variable and supplemental grooves are more numerous.</li> </ul>

**Q 3. What are arch and class traits of molars?**

(Oct. 2002)

- Describe the morphology of mandibular first molar. (May 2009)
- Write a note on its pulp cavity. (Nov. 2010, June 2012)

**Ans. Class Traits of Molars**

1. Molars are wider mesiodistally than cervicoocclusally.
2. They are the largest and strongest teeth. They have the largest occlusal surface of all the posterior teeth.
3. They are the only teeth having at least two buccal cusps.
4. They have 3–5 cusps and 2–3 roots.
5. Molars are not succedaneous teeth.

**Arch Traits of Molars**

<i>Maxillary molar</i>	<i>Mandibular molar</i>
1. Crowns of maxillary molars are wider bucco-palatally than mesiodistally.	1. Crowns are wider mesiodistally than bucco-palatally/lingually.
2. 3 roots are present in maxillary molars.	2. 2 roots are present in mandibular molars.
3. There is presence of oblique ridge on the occlusal surface.	3. There is no oblique ridge on the occlusal surface.
4. Maxillary molars are centred over their root axis.	4. Mandibular molars, from proximal aspect appear to be tilted lingually.
5. Root trunk is longer.	5. Root trunk is shorter.

## MANDIBULAR FIRST MOLAR

### Morphology of Mandibular First Molars

#### Introduction

- It is the largest tooth in the mandibular arch.
- It is located sixth from the midline.
- It has the widest mesiodistal dimension of all the teeth.
- It normally exhibits **five functional cusps and two well-developed roots**, one mesial and one-one distal which are very broad buccolingually.
- The crown is wider mesiodistally (MD) than buccolingually (BL).
- Flattened buccal cusps are typical of all mandibular molars.

#### Eruption

It erupts at around 6 years of age.

#### Numbering System

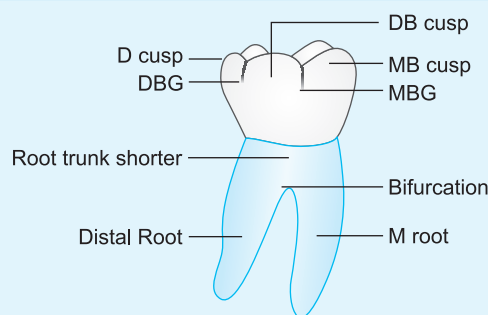
Palmer:  $\begin{array}{c} | \\ 6 \end{array} \begin{array}{c} | \\ 6 \end{array}$

Universal: # 30, 19

FDI: 46, 36

*Mandibular first molar from each aspect*

#### Buccal aspect



**Fig. 5.9**

#### Crown:

*Shape, size, and surface:*

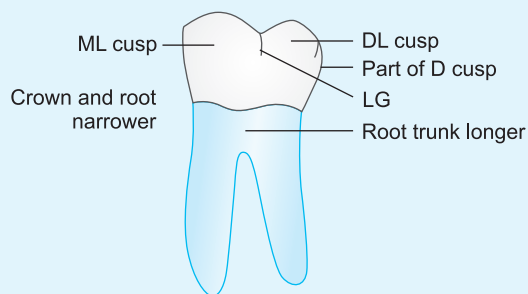
- It has trapezoidal, shape with longer parallel side towards occlusal and shorter parallel side towards cervical.
- There is proportionately more taper from contact area to cervix because of the bulge of the distal cusp.
- The crown is wider mesiodistally than cervicoocclusally.
- The crown is shorter from mesial to distal.
- It has 5 cusps, 3 buccal cusps and 2 palatal cusps which are just visible from this aspect.
- Mesio Buccal cusp (MB) is the widest, next is distobuccal cusp (DB) and distal cusp (D) is smallest and more pointed than either of buccal cusp. MB and DB cusps are relatively flat.

(Contd.)



*Mandibular first molar from each aspect (Contd.)*

- The two buccal cusps make-up the major portion of the buccal surface of the crown.
  - The distal cusp provides a very small part of the buccal surface because the major portion of the distal cusp makes up the distal portion of the crown providing the distal contact area on the centre of the distal surface of the distal cusp.
  - The mesiobuccal and distobuccal cusps are separated by mesiobuccal groove (MBG) which is longer and terminates in a pit.
  - The distobuccal and distal cusps are separated by a shorter distobuccal groove (DBG).
- Outline:**
- Mesial outline of the crown is concave from contact area to cervix.
  - Distal outline of the crown is straight from contact area to cervix.
  - At contact areas both outlines are convex.
  - Cervical line is almost straight, dipping apically towards the root bifurcation.
- Contact areas:**
- Mesial contact area is more occlusal.
  - It is close to the junction of occlusal and middle third.
  - Distal contact area is cervical to the mesial contact area.
- Root:**
- The **root** is bifurcated near the cervical line.
  - The **root trunk** is shorter (3 mm) and a depression is present.
  - The **roots** are widely separated.
  - The mesial root is longer, curved mesially from a point near the cervical line to the middle third then curves distally so that the tapered apex of the root is in line with the mesiobuccal groove.
  - The distal root is shorter, straighter with pointed apex which extends beyond the distal of the crown.
  - Both roots are wider mesiodistally at the buccal areas than they are lingually.
  - The developmental depressions are present on the mesial and distal sides of both the roots.

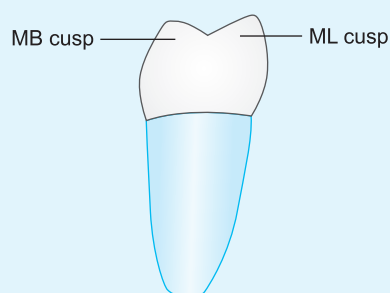
**Lingual aspect****Fig. 5.10****Crown:***Shape, size, and surface:*

- The crown is trapezoidal in shape. It is narrower from buccal to lingual.
- The **lingual cusps** are longer and sharper than the buccal cusps therefore from this aspect only mesiolingual and distolingual cusps and part of distal cusp is seen.
- The lingual groove (LG) separates the mesiolingual cusp from the distolingual cusp.

*(Contd.)*

*Mandibular first molar from each aspect (Contd.)***Root:**

- Mesiolingual cusp is slightly larger than the distolingual cusp.
- The tip of the mesiolingual cusp is somewhat higher than that of the distolingual tip.
- Cervical line is almost straight may dip cervically over the bifurcation.
- Roots are narrower on this aspect.
- Root trunk is longer on this aspect 4 mm because the cervical line is more occlusally placed.

**Proximal aspect****Fig. 5.11****Crown:***Shape, size, and surface:**Cusps and outline:**Distal aspect:**Cusps and outline:**Mesial aspect:**Cervical line:**Marginal ridge:**Buccal and lingual outline:**Contact areas:*

- The proximal surface has **rhomboidal shape** due to the lingual tilt of the crown in relation to root axis.
- The crown is shorter, narrower on distal aspect and the crown has a distal tilt therefore, more of occlusal surface and some part of each of the five cusps can be seen.
- And also more of buccal and lingual surface is seen from distal aspect.
- Buccolingual dimension of the crown and root is greater on the mesial aspect than on the distal and because the mesial cusps are higher, from mesial aspect only mesiobuccal and mesiolingual cusps and mesial root are seen.
- Mesial cervical line curves very slightly towards the occlusal.
- Distal cervical line is almost straight.
- Mesial marginal ridge (MMR) is longer, more occlusally placed and often crossed by mesial marginal groove.
- It is confluent with the mesial ridges of the MB and ML cusps.
- MMR is placed about 1 mm below the level of the cusp tips.
- There is a V-shaped notch at the mid-point of both the marginal ridges.
- The distal marginal ridge is short and more cervically placed.
- The buccal outline is more convex in the cervical third and in the occlusal two-thirds it becomes flatter.
- The MB cusp is located directly above the buccal third of the mesial root.
- The cervical ridge is less prominent.
- The lingual outline is straight from the cervix to the maximum convexity in the middle third, from this point it is curved towards the mesiolingual cusp tip. The tip of the mesiolingual cusp is in a position directly above the lingual third of the mesial root.
- The mesial contact area is almost centred buccolingually and is placed at the junction of occlusal and middle third.

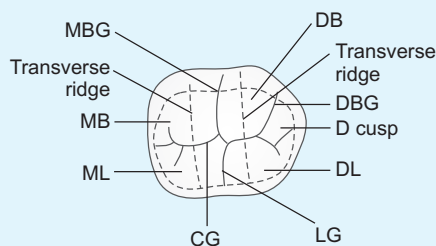
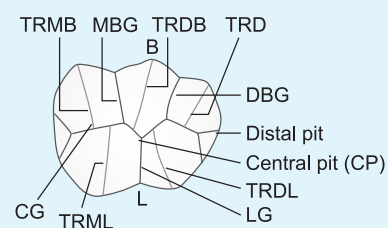
(Contd.)

*Mandibular first molar from each aspect (Contd.)***Root:**

- The distal contact area is placed just below the distal cusp ridge of the distal cusp at the middle of middle third.
- From mesial aspect only mesial root is seen which is wide buccolingually and has a deep depression on the mesial as well as inner surface. It has a blunt, wide apex.
- The distal root is narrower and shorter with a point apex.
- There is a shallow depression present on the distal surface of the distal root.

**Occlusal aspect**

Crown is MD &gt; BL

**Fig. 5.12A****Fig. 5.12B:** Triangular ridges and Grooves no transverse ridge*Shape and size:*

- Occlusal surface is quadrilateral in form but due to the presence of buccal bulge of the distobuccal cusp and small distal cusp, it has a hexagonal shape.
- Mesiodistal (MD) dimension is 1 mm more than the buccolingual (BL) dimension.
- Crown tapers from mesial to distal therefore the crown is wider buccolingually on mesial half than on the distal half.
- Widest buccolingual (BL) dimension is in the middle third of the distobuccal cusp.
- Because of the lingual inclination of the crown more of the buccal surface is visible than the lingual surface.
- The crown narrows from buccal to lingual.
- Outline of the crown is convex on buccal, lingual, mesial, distal.
- The occlusal surface includes the cusps, the ridges, the fossae and the grooves.
- There are five **triangular ridges**, 3 **fossae**, 3 **pits** and 4 **developmental grooves**.

*Cusps:*

- Mesio Buccal cusp is larger than mesiolingual and distolingual cusps which are almost equal in size.
- Distobuccal is smaller than the mesio Buccal, mesiolingual, distolingual, and distal cusp is the smallest.

*Ridges (Fig. 5.12B)*

- Some texts refer that the occlusal surface of mandibular first molar has no transverse ridge.
- The triangular ridge of the mesio Buccal cusp (TRMB) extends lingually to end at the mesial portion of the central groove.
- The triangular ridge of the distobuccal (TRDB) cusp extends mesiolingual to the area of the central pit.
- The triangular ridge of the distal cusp (TRD) extends mesiolingual to the distal pit area.

(Contd.)

*Mandibular first molar from each aspect (Contd.)**Ridges (Fig. 5.12A)*

- The triangular ridge of the mesiolingual cusp (TRML) extends distobuccal to end at the mesial portion of the central groove.
- The triangular ridge of the distolingual cusp (TRDL) extends mesiobuccally to end in the area of the junction of the distobuccal groove (DBG) and the distal portion of the central groove.
- Other texts refer that the occlusal surface of mandibular first molar has two transverse ridges.
- The triangular ridges (TR) of the mesiobuccal and mesiolingual cusps (TRMB and TRML) meet to form a transverse ridge.
- The triangular ridges of distobuccal and distolingual cusps (TRDB and TRDL) form a second transverse ridge.
- Since the lingual cusps are higher, TR of lingual cusps of first molars are longer than the TR of buccal cusps.

*Fossa:*

- There is one major fossa and two minor fossae.
- The major fossa is the central fossa. It is roughly circular and it is centrally placed on the occlusal surface between the buccal and lingual cusp ridges.
- All of the developmental grooves converge in the centre of the central fossa at the central pit.
- Mesial triangular fossa is smaller and distal triangular fossa is smallest.

*Grooves:*

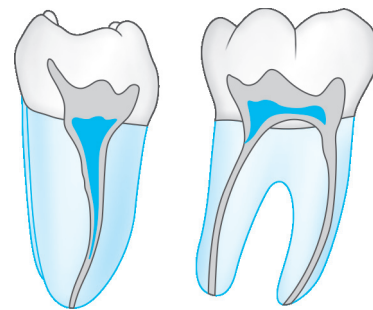
- There are 4 developmental grooves. Central developmental groove (CG), mesiobuccal developmental groove (MBG), the distobuccal developmental groove (DBG) and the lingual developmental groove (LG).
- Central groove (CG) extends from mesial pit to distal pit and has a zigzag course mesiodistally (MD).
- Mesial portion of the central groove extends from central pit mesiobuccally for short distance, joins the mesiobuccal groove, then separates and continues mesially to the mesial pit.
- Distal portion of CG extends from Central pit in distobuccal direction to a point, where it is joined by DBG. From this point, CG courses in distolingual direction terminating in the distal pit.
- MBG extends mesiobuccally from the central pit for short distance to traverse on to the buccal surface passing between the MB and DB cusps.
- LG extends lingually from the central pit between the mesiolingual and distolingual cusps but rarely extends on to the lingual surface.

**PULP CAVITY OF MANDIBULAR FIRST MOLAR****Pulp Chamber (PC)**

- Roof of pulp chamber is rectangular in cross-section.
- It has four pulp horns MB, DB, ML, DL.
- Floor of the PC is rhomboid in cross-section.
- It has 2 funnel-shaped openings of the mesial root canals and 1 opening of the distal canal.

**Root Canals**

- The molar has two separate and distinct roots :
- The mesial root has 2 distinct canals leaving the floor.
- It has a more complicated RC system because of presence of two root canals.

**Fig. 5.12C:** Mandibular first molar

- The mesial canals may be severely curved or straight.
- The two canals may join each other and exit in a single foramen or may exit in separate foramen.
- The distal root has one large, straighter and shorter root canal, may have two canals.

#### Q 4. Describe morphology of mandibular second molar.

(May 2008)

##### Ans. Introduction

- It is the second largest tooth in the mandibular arch.
- It is located seventh from the midline.
- It resembles the first molar in many respects, although it is more symmetrical and smaller in all dimensions.
- It has the least complicated occlusal design of any molar.
- Normally only four cusps present.

##### Eruption

It erupts at around twelve years of age.

##### Numbering System

Palmer:  $\frac{7}{7}$

Universal: R # 31 L # 18

FDI: R 47 L 37

Mandibular second molar from each aspect

##### Buccal aspect

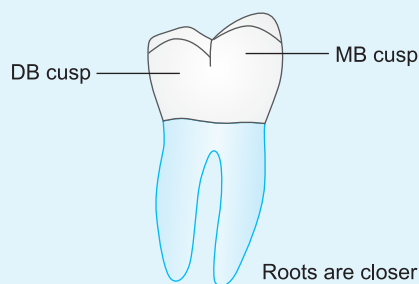


Fig. 5.13

##### Crown :

Shape, size, surface:

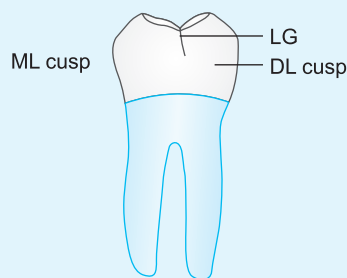
- It has trapezoidal shape with longer parallel side towards the occlusal and shorter towards the cervical.
- The crown tapers from contact area to the cervix.
- The crown is shorter from mesial to distal.
- It has four cusps, two buccal and two lingual which are just visible from the aspect.
- Mesiobuccal (MB) cusp wider than distobuccal cusp. Two buccal cusps are separated by a buccal groove which terminates in a pit.
- Mesial border of the crown is either straight or concave from contact area to cervix.

Outline:

(Contd.)

*Mandibular second molar from each aspect (Contd.)*

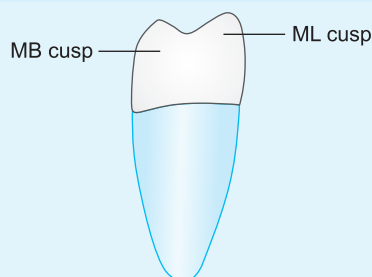
- Contact area:**
- Distal border is either straight or convex from contact area to cervix.
  - At contact area both outlines are convex.
  - Cervical line is almost straight and points towards bifurcation.
  - Occlusal border is flattened.
- Root:**
- Mesial contact area is more occlusal. It is close to the junction of occlusal and middle-third.
  - Distal contact area is cervical to the mesial contact area.
  - Two roots. Mesial root slightly longer than the distal root.
  - Root bifurcation is near the cervical line.
  - The root trunk is longer as compared to that of the first molar.
  - Roots are more or less parallel, i.e. less separated.
  - Either both the root apices are directed towards the centre line or both the roots curve distally.
  - Both the roots taper apically in a pointed apex.

**Lingual aspect****Fig. 5.14****Crown:***Shape, size, and surface:*

- The crown is trapezoidal in shape.
- It is narrow from buccal to lingual.
- Since the lingual cusps are longer and sharper than the buccal cusps, from this aspect only ML and DL cusps are seen.
- Lingual groove separates the mesiolingual and the distolingual cusps.
- Cervical line is straight, may dip cervically over the bifurcation.

**Root:**

- Roots are narrower on this aspect.
- Root trunk appears longer because cervical line is more occlusal on lingual.

**Proximal aspect****Fig. 5.15***(Contd.)*

*Mandibular second molar from each aspect (Contd.)***Crown:**

*Shape, size, and surface cusps:* • The proximal surface has rhomboid shape due to the lingual tilt of the crown in relation to root axis.

**Distal aspect:**

- Due to the distal tilt of the crown and crown being shorter and narrower on this aspect, more of occlusal surface, part of MB and ML cusps are also seen behind the DB and DL cusps and also more of buccal and lingual surface is seen.

**Mesial aspect:**

- Buccolingual dimension of the crown and root is more on the mesial aspect than on the distal and because the mesial cusps are longer, from this aspect only mesiobuccal and mesiolingual cusps and mesial root are seen.

**Outline:**

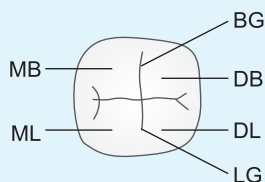
- Buccal outline is more convex in the cervical third and the lingual outline is more convex in the middle third.
- **The lingual cusp tips** more pointed than buccal cusp tips.
- The buccal cervical ridge is more prominent.
- Mesial cervical line is curved very slightly towards the occlusal.
- Distal cervical line is almost straight.
- Mesial marginal ridge is longer, more occlusally placed, has a sharp V-shaped notch and is crossed by mesial marginal ridge groove.
- DMR is shorter and more cervically placed.

**Contact areas:**

- Mesial contact area is almost centred buccopalatally and is placed at the junction of occlusal and middle third.
- Distal contact area also centered buccolingually and is placed equidistant from the cervical line and the marginal ridge.

**Root:**

- From mesial aspect compared to first molar the root is less wide buccolingually and narrower in the cervical third ending in a pointed apex.
- Deep depression on mesial surface of mesial root.
- Distal root is less wide, shorter with pointed apex.

**Occlusal aspect****Fig. 5.16****Shape and size:**

- Occlusal surface has a rectangular shape because of four cusps.
- The crown is wider mesiodistally than buccolingually.
- Crown tapers from mesial to distal.
- It is widest at mesiobuccal cusp because of prominent buccal cervical ridge.
- Because of the lingual inclination of the crown more of the buccal surface is visible than the lingual surface.
- Crown narrows from buccal to lingual.

**Outline:**

- Mesial outline is straight and longer, distal outline is convex and shorter.

**Cusp:**

- The occlusal surface includes cusps fossae, ridges and grooves.

(Contd.)

	<i>Mandibular second molar from each aspect (Contd.)</i>
	<ul style="list-style-type: none"> <li>The four cusps are more nearly equal even so MB is largest and DL is smallest.</li> <li>Palatal cusps are long and sharp.</li> </ul>
<i>Ridges:</i>	There are four triangular ridges and two transverse ridges.
<i>Groove:</i>	<p>Groove pattern is simple cross-type.</p> <p>Three major grooves present.</p> <ul style="list-style-type: none"> <li>The central groove (CG), the buccal groove (BG), and the lingual groove (LG). MMRG and supplemental grooves also present.</li> <li>The central groove extends from the central pit mesially and distally in a straight line.</li> <li>Buccal and lingual grooves extend from central pit buccally and lingually onto the buccal and lingual surfaces to form a cross-pattern.</li> </ul>
<i>Fossa:</i>	<p>There are three fossae:</p> <ul style="list-style-type: none"> <li>The major, large, circular central fossa and two minor mesial and distal triangular fossae.</li> </ul>

### SAQ (3 Marks)

#### Q 1. Describe arch traits of molars.

(2000, May 2007)

**Ans. Arch traits of molars and differences between maxillary and mandibular molars:**

<i>Maxillary molar</i>	<i>Mandibular molar</i>
<ul style="list-style-type: none"> <li>The crowns of maxillary molars have three large cusps and one smaller cusp the distopalatal cusp.</li> <li>Developmentally—three major cusps</li> </ul>	<ul style="list-style-type: none"> <li>Mandibular molars have four relatively /large cusps, two buccal and two lingual.</li> <li>Developmentally—four major cusps.</li> </ul>
<b>Buccal aspect</b>	
<ul style="list-style-type: none"> <li>Buccal surface of the crown relatively vertical and flat.</li> <li>The crown does not appear to be tilted.</li> <li>Buccal cusps not flattened</li> <li>Two buccal cusps and one buccal groove</li> </ul>	<ul style="list-style-type: none"> <li>Buccal surface of the crown is convex.</li> <li>First molar crown appears to tip distally relative the root axis due to increase taper from contact area to the cervical line.</li> <li>Buccal cusps flattened.</li> <li>In second molar, two buccal cusps and one buccal groove but in first M three buccal cusps and two buccal grooves.</li> </ul>
<b>Palatal aspect</b>	
<ul style="list-style-type: none"> <li>Palatal cusps are unequal in size with MP cusp being largest and longest.</li> <li>A fifth smaller cusp found on the palatal surface of the MP cusp of the Maxillary first molar.</li> </ul>	<ul style="list-style-type: none"> <li>Lingual cusps are almost equal in size.</li> <li>No cusp of carabelli present on the palatal/lingual surface.</li> </ul>
<b>Proximal aspect</b>	
<ul style="list-style-type: none"> <li>Maxillary molars are centered over their roots.</li> </ul>	<ul style="list-style-type: none"> <li>Mandibular molar crowns are tilted lingually.</li> </ul>

(Contd.)



<i>Maxillary molar</i>	<i>Mandibular molar (Contd.)</i>
<b>Occlusal aspect</b>	
<ul style="list-style-type: none"> <li>• From this aspect crown is wider bucco-palatally than mesiodistally.</li> <li>• The largest and longest MP cusp is connected to the DB cusp by an oblique ridge.</li> <li>• There is no palatal tilt, therefore buccal surface not seen.</li> <li>• One transverse ridge from MB cusp to MP cusp.</li> <li>• Four fossae.</li> <li>• CG from central pit to mesial pit.</li> <li>• Palatal groove/LG extends from distal pit and parallel to oblique ridge.</li> </ul>	<ul style="list-style-type: none"> <li>• From this aspect crown are wider mesiodistally than buccolingually.</li> <li>• There is no oblique ridge present.</li> <li>• Since the crown is tilted lingually more of buccal surface is seen from this aspect.</li> <li>• Two transverse ridges from MB to ML cusp and from DB to DL cusp.</li> <li>• Three fossae.</li> <li>• CG from mesial pit to central pit to distal pit.</li> <li>• LG extends from central fossa and at right angles to central groove.</li> </ul>

### Q 3. Describe type traits of maxillary molars.

(June 2006, 2011)

Ans.

<i>Maxillary first molar</i>	<i>Maxillary second molar</i>
<ul style="list-style-type: none"> <li>• It erupts at 6-year of age.</li> <li>• It is the largest tooth in the arch.</li> <li>• It is least variable of all maxillary molars and it has rhomboid shape.</li> <li>• Buccopalatally both molars are same in dimension.</li> <li>• The crown is wider on palatal.</li> <li>• MB cusp longer and wider than DB cusp.</li> <li>• DP/DL cusp slightly smaller than MP.</li> <li>• Cusp of Carabelli present on palatal surface of MP cusp.</li> <li>• <b>The three roots</b> more divergent and are outside the confines of the crown.</li> <li>• MB and DB roots are curved like handle of pliers.</li> <li>• Palatal root is longest and has banana shape.</li> <li>• Less prominent MB cervical ridge.</li> <li>• More prominent oblique ridge (OR)</li> <li>• Fewer supplemental grooves</li> </ul>	<ul style="list-style-type: none"> <li>• It erupts at 12-year of age.</li> <li>• It is smaller than the first.</li> <li>• Three cusps type is heart-shaped or four cusp type has accentuated rhomboid shape.</li> <li>• But mesiodistally second molar is narrower than the first molar.</li> <li>• Crown is narrower towards palatal.</li> <li>• MB cusp <b>much wider</b> than DB cusp.</li> <li>• DP cusp is much smaller than MP cusp.</li> <li>• No cusp of Carabelli.</li> <li>• The three roots <b>less divergent</b> and are within the confines of the crown.</li> <li>• MB and DB roots are more or less parallel.</li> <li>• Palatal root is straight.</li> <li>• More prominent MB cervical ridge.</li> <li>• Smaller and less prominent OR.</li> <li>• More supplemental grooves.</li> </ul>

### Q 4. What is Cope Osborn hypothesis?

(Nov. 2004)

Ans. **Cope Osborn Hypothesis**

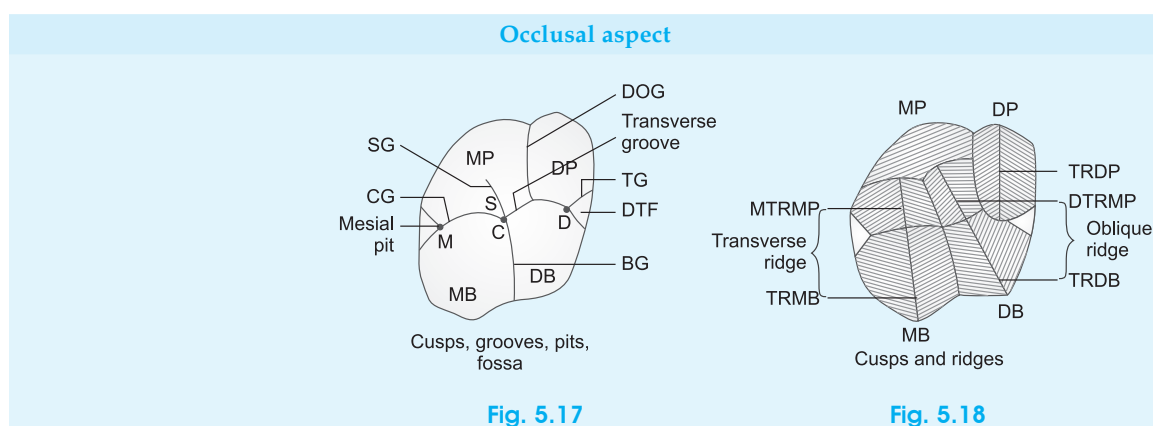
- The occlusal table of the maxillary first molar may be divided into two distinct components the trigon and the talon by an oblique ridge.
- The triangular shape is formed by the three major cusps mesiobuccal, distobuccal, mesio-palatal collectively known as “maxillary molar primary cusp triangle” or “Trigon” made by tracing the cusp outlines of these cusps, the MMR, and the oblique ridge and ridges of the occlusal surface.
- Developmentally only three major cusps may be considered as primary cusps the mesio-palatal cusp which is most primitive and two buccal cusps.
- The distopalatal cusp common to all maxillary molars and cusp of Carabelli on first molar maybe regarded as secondary cusps.

- Maxillary molar primary cusp triangle supposition follows “Cope Osborn hypothesis of tooth origin.”
- There was a tritubercular stage in human tooth development when the molars had three cusps.
- The primary triangular design is also reflected in the outline of the root trunk when the tooth is sectioned in that area.
- One more observation that supports the explanation of maxillary molar having three major primary cusps is that distopalatal cusp becomes progressively smaller on second and third molars, often disappears as a major cusp.

**Q 5. Draw, label occlusal surface of maxillary first molar.**

(June 2005, 2010, 2013, Nov. 2009)

**Ans.**



**Fig. 5.17**

**Fig. 5.18**

**Crown:**

*Shape, outline, cusps:*

- From this aspect it has somewhat rhomboid outline following the four major cusp ridges and the marginal ridges (MR).
- **Buccopalatal dimension** is more than mesiodistal dimension.
- Crown tapers from mesial to distal.
- In maxillary first molar the palatal side may be wider as compared to the buccal.
- The four major cusps and one minor cusp present.
- The mesiopalatal (MP) cusp is the largest with a rounded cusp tip.
- Distopalatal cusp (DP) is the smallest and most variable.
- Mesiobuccal (MB) cusp is second largest with sharp cusp tip and is slightly larger than the distobuccal cusp.
- The distobuccal cusp (DB) is the third largest with sharpest cusp tip.

*Fossa:*

- There are two major fossae and two minor fossae.
- The major fossa is the central fossa which is roughly triangular and mesial to the oblique ridge and the distal fossa (cigar fossa) which is linear and distal to and parallel to the oblique ridge (OR).
- The central fossa has connecting sulci within its boundaries with developmental grooves at the deepest portion of these sulci (sulcate grooves).
- The two minor fossae are the mesial triangular fossa (MTF) and the distal triangular fossa (DTF) which are located distal to and mesial to the MMR and the DMR.

(Contd.)

**Occlusal aspect (Contd.)****Ridges:**

- The mesiopalatal cusp has two triangular ridges (TR).
- The distopalatal cusp has a straight single triangular ridge.
- The groove between the two triangular ridges of the mesiopalatal cusp is the "Stuart groove" (SG).
- The distal triangular ridge of mesiopalatal cusp (DTRMP) and the triangular ridge of distobuccal cusp (TRDB) join to form a diagonal or oblique transverse ridge called "Oblique ridge" (OR).
- Other texts refer to **DTRMP** by another name the **distal cusp ridge of mesiopalatal cusp (DCRMP)**: Subsequently the OR is formed by union of triangular ridge of distobuccal cusp and distal cusp ridge of mesiopalatal cusp (Refer page 399 Fig. 25.132).
- The oblique ridge is reduced in height in the centre of the occlusal surface being about on the level of the marginal ridges of the occlusal surface sometimes it is crossed by a developmental groove that partially joins the two major fossa by means of a shallow sulcate groove.
- The mesial triangular ridge of mesiopalatal cusp (MTRMP) joins the triangular ridge of the mesiobuccal (TRMB) cusp to form a transverse ridge.
- The MMR and the DMR are irregular ridges confluent with the mesial and distal cusp ridges of the mesial and distal major cusps.

**Pits:**

- The central pit (C) is located at the centre of the central fossa.
- Mesial (M) and distal pits (D) are located at the bottom of the mesial and distal fossa.

**Grooves:**

- There are 5 major developmental grooves. CG the central groove, the buccal groove BG, DOG the distal oblique groove, PG the palatal groove, and sometimes the transverse groove of the oblique ridge and the fifth cusp developmental groove.
- **Central groove (CG)** extends in mesial direction at an obtuse angle to buccal groove from the central pit (over the mesial transverse ridge) and ends in the mesial triangular fossa.  
A short developmental groove radiates from the central pit, extend distopalatally where it other crosses the oblique ridge and ends in the distal fossa or fades out before reaching the OR.  
This part of the CG which extends over the oblique ridge is called the **transverse groove** of the oblique ridge, it is a shallow developmental groove.
- **Buccal groove (BG)** extends from the central pit in buccal direction on to the buccal surface.
- **Distal oblique groove (DOG)** or linear groove or distopalatal groove extends obliquely and traverses the distal linear fossa to join the palatal developmental groove between the mesiopalatal and distopalatal cusps. It shows several supplemental grooves. At distal pit it terminates into two branches (TG) which form the two sides of the distal triangular fossa (DTF).
- **Palatal developmental groove (PG)** separates the MP and DP cusps and extends on the palatal surface to terminate at the centre of the crown palatally below the palatal root.
- **Fifth cusp groove** outlines the fifth cusp (cusp of carabelli) it joins the palatal groove near its terminus.

The other grooves are :

- Distal marginal groove (DMG).
- Distobuccal triangular groove and distopalatal triangular groove.
- Mesial marginal groove.
- Mesiobuccal triangular groove and mesiopalatal triangular groove.

**Q 6. Describe the occlusal surface of mandibular first molar.**

(Nov. 2009, May 2015)

**Ans.**

Occlusal aspect	
Crown is MD > BL	
<p><b>Fig. 5.19A</b></p>	<p><b>Fig. 5.19B</b></p>
<p><i>Shape and size:</i></p>	<ul style="list-style-type: none"> <li>• Occlusal surface is quadrilateral in form but due to the presence of buccal bulge of the distobuccal cusp and small distal cusp, it has a pentagon shape.</li> <li>• Mesiodistal dimension is 1 mm more than the buccolingual dimension.</li> <li>• Crown tapers from mesial to distal therefore the crown is wider buccolingually on mesial half than on the distal half.</li> <li>• Widest buccolingual dimension is in the middle third of the distobuccal cusp.</li> <li>• Because of the lingual inclination of the crown more of the buccal surface is visible than the lingual surface.</li> <li>• The crown narrows from buccal to lingual.</li> <li>• Outline of the crown is convex on buccal, lingual, mesial, distal.</li> <li>• The occlusal surface includes the cusps, the ridges, the fossae and the grooves.</li> <li>• There are five triangular ridges, three fossae, three pits and four developmental grooves.</li> </ul>
<p><i>Cusps:</i></p>	<ul style="list-style-type: none"> <li>• Mesiobuccal cusp is larger than mesiolingual and distolingual cusps which are almost equal in size, distobuccal cusp is smaller than the mesiobuccal, mesiolingual, distolingual and distal cusps is the smallest.</li> </ul>
<p><i>Ridges: (Fig. 5.19B)</i></p>	<ul style="list-style-type: none"> <li>• Some texts refer that the occlusal surface of mandibular first molar has no transverse ridge.</li> <li>• The triangular ridge of the mesiobuccal cusp (TRMB) extends lingually to end at the mesial portion of the central groove.</li> <li>• The triangular ridge of the distobuccal cusp (TRDB) extends mesiolingual to the area of the central pit.</li> <li>• The triangular ridge of the distal cusp (TRD) extends mesiolingual to the distal pit area.</li> <li>• The triangular ridge of the mesiolingual cusp (TRML) extends distobuccal to end at the mesial portion of the central groove.</li> <li>• The triangular ridge of the distolingual cusp (TRDL) extends mesiobuccally to end in the area of the junction of the distobuccal groove (DBG) and the distal portion of the central groove.</li> </ul>
<p><i>Ridges: (Fig. 5.19A)</i></p>	<ul style="list-style-type: none"> <li>• Other texts refer that the occlusal surface of mandibular first molar has two transverse ridges.</li> <li>• The triangular ridges (TR) of the mesiobuccal and mesiolingual cusps (TRMB and TRML) meet to form a transverse ridge.</li> </ul>

(Contd.)

**Occlusal aspect (Contd.)****Fossa:**

- The triangular ridges of distobuccal and distolingual cusps (TRDB and TRDL) form a second transverse ridge.
- Since the lingual cusps are higher, TR of lingual cusps of first molars are longer than the TR of buccal cusps.
- There is one major fossa and two minor fossae.
- The major fossa is the central fossa. It is roughly circular, and it is centrally placed on the occlusal surface between the buccal and palatal cusp ridges.
- All of the developmental grooves converge in the centre of the central fossa at the central pit.
- Mesial triangular fossa is smaller and distal triangular fossa is smallest.

**Grooves:**

- There are four developmental grooves. Central developmental groove (CG), mesiobuccal developmental groove (MBG), the distobuccal developmental groove (DBG) and the lingual developmental groove (LG).
- Central groove (CG) extends from mesial pit to distal pit and has a zigzag course mesiodistally.
- Mesial portion of the central groove extends from central pit mesiobuccally for short distance via mesiobuccal groove, then separates and continues mesially to the mesial pit.
- Distal portion of the central groove extends from distal pit passes mesio-buccally to becomes confluent with the distobuccal groove (DBG).
- MBG extends mesiobuccally from the central pit for short distance to traverse on to the buccal surface passing between the MB and DB cusps.
- LG extends lingually from the central pit between the mesiolingual and distolingual cusps but rarely extends on to the lingual surface.

**Q 7. What is endodontic anatomy of maxillary first molar?**

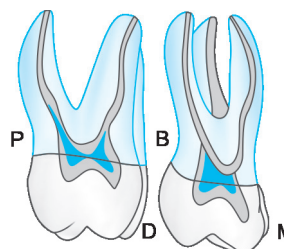
(Nov. 2009)

**Ans. Endodontic Anatomy of Maxillary First Molar****Pulp Chamber (PC)**

- It has large pulp chamber with four pulp horns mesiobuccal, distobuccal, mesiopalatal and distopalatal.
- Roof of the pulp chamber is rhomboid in cross-section whereas the floor of the PC is triangular in cross-section.
- The three orifices of the root canals are present at triangles of the floor.
- It an accessory mesiobuccal canal is present the 4th canal orifice may be present at its palatal end.
- Mesiobuccal orifice under the mesiobuccal cusp is long buccopalatally.
- Distobuccal orifice is slightly mesial and palatal to the mesiobuccal orifice.
- Palatal orifice is largest, is round or oval and is centered palatally.

**Root and Root Canals**

- It usually has three roots and three canals. Mesiobuccal root usually possesses an accessory canal.
- The mesiobuccal canal is often very small and curved but some may be wide.
- The palatal root canal is the largest.

**Fig. 5.20:** Maxillary first molar

- The distobuccal root canal is straighter and smaller and centred.
- The entire removal of pulp is an impossibility in many maxillary first molars because of the complexities of the root canal system.

**Q 8. What is cusp of Carabelli?**

**Ans. Cusp of Carabelli**

- It is a supplemental cusp palatal to mesiopalatal cusp which is largest of the well-developed cusps of the deciduous and permanent maxillary first molar.
- Usually a developmental groove is found.
- This morphological trait can take the form of a well-developed fifth cusp, or it can grade down to a series of grooves, depressions or pits on the mesial portion of the palatal surface.
- This trait has been used to distinguish populations.
- Fifth cusp or a developmental trace at its usual site serves to identify the maxillary first molar.

### MULTIPLE CHOICE QUESTIONS (MCQs)

1. The molar having the crown, wider bucco-palatally than mesiodistally is
  - a. Maxillary molars
  - b. Mandibular molars
  - c. Both
  - d. None
2. The cusp or tubercle of Carabelli is found in
  - a. Mandibular second molar
  - b. Maxillary second molar
  - c. Maxillary first molar
  - d. Mandibular first molar
3. The largest cusp on the maxillary molars is
  - a. Mesiopalatal
  - b. Mesiobuccal
  - c. Distobuccal
  - d. Distopalatal
4. The three roots in maxillary molars are
  - a. Mesiopalatal, distopalatal, and buccal
  - b. Mesiobuccal, mesiopalatal, and distal
  - c. Mesiobuccal, distobuccal, and palatal
  - d. None of the above
5. The longest root in maxillary first molar is
  - a. Mesiobuccal
  - b. Distobuccal
  - c. Palatal
  - d. None of the above
6. In maxillary first molar, bifurcation is seen from
  - a. Buccal aspect
  - b. Proximal aspect
  - c. Both a and b
  - d. Palatal aspect
7. From the occlusal aspect the crown is rhomboid in shape, wider bucco-palatally than mesiodistally, is the characteristic of
  - a. Maxillary molars
  - b. Mandibular molars
  - c. Maxillary and mandibular molars
  - d. Maxillary premolars
8. The oblique ridge is formed by the union of triangular ridge of
  - a. Distobuccal cusp and distal ridge of mesiopalatal cusp
  - b. Mesiobuccal cusp and distopalatal cusp
  - c. Mesiopalatal and mesiobuccal cusp
  - d. Distobuccal and distopalatal
9. The developmental groove traversing from the linear distal fossa which connects with the palatal development groove is called the
  - a. Distal developmental groove
  - b. Distopalatal groove
  - c. Distal oblique groove
  - d. Mesial development groove
10. The crown with more extreme rhomboid outline, having buccal roots that are more nearly parallel is the characteristic of
  - a. Maxillary first molar
  - b. Maxillary second molar
  - c. Maxillary third molar
  - d. Mandibular first molar
11. The poor development of distopalatal cusp and heart shape form is common to
  - a. Maxillary first molar
  - b. Maxillary second molar
  - c. Maxillary second and third molar
  - d. Mandibular second molar
12. The apex of the palatal root of maxillary second molar is
  - a. In line with the palatal groove
  - b. In line with the distopalatal cusp tip
  - c. In line with mesiopalatal cusp tip
  - d. In line with root axis
13. The apex of palatal root of maxillary first molar is
  - a. In line with the palatal groove
  - b. In line with the distopalatal cusp tip
  - c. In line with mesiopalatal cusp tip
  - d. In line with root axis

1-a, 2-c, 3-a, 4-c, 5-c, 6-c, 7-a, 8-a, 9-c, 10-b, 11-c, 12-b, 13-a

- 14. Crowns are wider mesiodistally than buccopalatally in**  
a. Maxillary molars  
b. Mandibular molars  
c. Both a and b  
d. Mandibular second premolar
- 15. Taper of crown from B to L is more in**  
a. Maxillary first  
b. Maxillary second  
c. Maxillary third  
d. None of the above
- 16. From proximal view the crown is tilted palatally at cervix in**  
a. Maxillary molars  
b. Mandibular molars  
c. Mandibular premolars  
d. Both b and c
- 17. The longest pulpal horn in mandibular permanent first molar is**  
a. Distobuccal  
b. Mesiobuccal  
c. Distopalatal  
d. Mesiopalatal
- 18. In maxillary first molar the root which is more often curved is**  
a. Mesiobuccal    b. Distobuccal  
c. Palatal        d. Mesiopalatal
- 19. Molars having short root trunk and two roots M and D are**  
a. Maxillary molars  
b. Mandibular molars  
c. Both  
d. None
- 20. The most common feature to differentiate between maxillary first, second, and third molars is**  
a. Position of distopalatal groove and size of DL cusp  
b. Number of roots  
c. Cusp of Carabelli  
d. All the above
- 21. Flattened buccal cusps are typical of all**  
a. Maxillary first molars  
b. Mandibular molars  
c. All mandibular premolars  
d. Maxillary second molar
- 22. The distal cusp of mandibular first molar is located**  
a. On distal surface of the teeth  
b. Part of it on palatal surface and part of it on distal surface  
c. Small portion on buccal and major portion on distal surface.  
d. On buccal surface
- 23. In mandibular first molar the mesiobuccal developmental groove is shorter of the two grooves and is situated**  
a. Mesial to the root bifurcation  
b. In line with the root bifurcation  
c. Distal to the root bifurcation  
d. None of the above
- 24. The mesial root and canal show considerable curvature, distal root is straighter and shorter than the curved mesial root is common to**  
a. Mandibular first molar  
b. Mandibular second molar  
c. Mandibular third molar  
d. Maxillary first molar
- 25. No transverse ridge, zigzag groove pattern, two buccal grooves, is the characteristic of permanent**  
a. Maxillary first molar  
b. Mandibular first molar  
c. Mandibular second molar  
d. Maxillary second molar
- 26. The widest mesiodistal dimension is found on permanent**  
a. Maxillary first molars  
b. Maxillary central incisors  
c. Mandibular first molars  
d. None of the above

14-b, 15-c, 16-d, 17-b, 18-a, 19-b, 20-a, 21-b, 22-c, 23-a, 24-a, 25-b, 26-c



- 27. The size of the cusps from largest to smallest in mandibular first molar is**
- Mesiopalatal, mesiobuccal, distobuccal, distopalatal, distal
  - Mesiopalatal, distopalatal, mesiobuccal, distobuccal, distal
  - Mesiopalatal, mesiobuccal, distopalatal, distobuccal, distal
  - Distopalatal, distal, mesiopalatal, mesiobuccal, distobuccal
- 28. The size of the cusps in maxillary first molar from largest to smallest**
- Mesiopalatal, distopalatal, mesiobuccal, distobuccal, cusp of Carabelli
  - Mesiopalatal, mesiobuccal, distobuccal, distopalatal, fifth cusp.
  - Mesiopalatal, mesiobuccal, distopalatal, distobuccal, fifth cusp
  - Distopalatal, distobuccal, mesiobuccal, mesiopalatal
- 29. Irregular groove pattern, numerous supplemental groove bulbous (B and L convex) and short crown, distal tilt is characteristic of**
- Mandibular third molars
  - Mandibular second molars
  - Maxillary third molars
  - Maxillary second molars
- 30. The largest tooth in the maxillary arch is**
- Maxillary first molar
  - Mandibular second molar
  - Mandibular first molar
  - Maxillary second molar
- 31. Using occlusal morphology as a guide, the mandibular third molar is most similar to the**
- Permanent maxillary first molar
  - Permanent mandibular first molar
  - Permanent mandibular second molar
  - Deciduous mandibular second molar
- 32. The cusp of Carabelli is located on the**
- Maxillary permanent third molar
  - Maxillary permanent first molar
  - Maxillary permanent CI
  - Maxillary permanent second molar
- 33. Oblique ridge connects**
- Mesiobuccal cusp to distopalatal cusp
  - Mesiobuccal cusp to distobuccal cusp
  - Mesiopalatal cusp to distopalatal cusp
  - None of the above
- 34. The occlusal surface of permanent maxillary first molar is**
- Oval in shape
  - Trapezoid in shape
  - Rectangular in shape
  - Rhomboid in shape
- 35. Fourth canal in maxillary first molar is commonly located in**
- Mesiobuccal root
  - Distobuccal root
  - Palatal root
  - None of the above
- 36. Wrinkled occlusal surface is found in**
- Mandibular third molars
  - Mandibular second molars
  - Maxillary third molars
  - Maxillary second molars
- 37. The mandibular first molars having sixth cusp located on the distal marginal ridge between the distal cusp and distopalatal cusp is named**
- Tubercle of carabelli
  - Tuberculum sextum
  - Tuberculum intermedium
  - Tubercle genial
- 38. Sixth cusp on mandibular first molar when located between two palatal cusps is named**
- Cusp of Carabelli
  - Genial tubercle
  - Tuberculum sextum
  - Tuberculum intermedium

27-b, 28-b, 29-a, 30-a, 31-c, 32-b, 33-d, 34-d, 35-a, 36-a, 37-b, 38-d

- 39. Primary feature that distinguishes maxillary molars from mandibular molars is**
- Number of roots
  - Number of cusps
  - Number of Surfaces
  - All of the above
- 40. A developmental groove that partially joins the two major fossae of maxillary first molar is**
- Stuart groove
  - Sulcate groove/transverse groove
  - Central groove
  - Buccal groove
- 41. The most symmetrical permanent molar is**
- Maxillary first molar
  - Maxillary second molar
  - Mandibular first molar
  - Mandibular second molar
- 42. Occlusocervically, the height of the distal marginal ridge of a permanent maxillary first molar is the same height as the following:**
- Mesial marginal ridge of maxillary second molar
  - MMR of mandibular first molar
  - MMR of mandibular second molar
  - DMR of maxillary second molar
- 43. A fissured groove is most frequently found on**
- Facial of maxillary molar
  - Palatal of maxillary molar
  - Facial of mandibular molar
  - Palatal of mandibular molar
- 44. The tooth most often restored, extracted or replaced is**
- Maxillary first molar
  - Maxillary third molar
  - Mandibular first molar
  - Mandibular first premolar
- 45. Pits in the occlusal surface of molars and premolars are at the junction of**
- Marginal ridge and inclined planes
  - Inclined planes and cusp tips
  - Development grooves
  - Facial and mesial surfaces
- 46. In permanent maxillary first molar, the level of the oblique ridge on the occlusal surface near the center is at a level with**
- Marginal ridges
  - Cusp of Carabelli
  - Tips of ML and DB cusps
  - Depth of central and distal fossa
- 47. In maxillary first M from which aspect bifurcation is closer to cervical line**
- Buccal
  - Mesial
  - Distal
  - Palatal
- 48. Pulp horn most likely to be exposed accidentally during class II cavity preparation in a maxillary first molar are**
- ML and DL
  - MB and ML
  - ML and DB
  - MB and DB
- 49. Primates have conical cusps and are called**
- Bunodont
  - Haplodont
  - Diphyodont
  - Bilophodont
- 50. Human teeth like incisors, canines premolars, molars can be described as**
- Monophyodont
  - Homodont
  - Heterodont
  - None of the above
- 51. Simplest form of tooth with single cone is called as**
- Haplodont
  - Triconodont
  - Tritubercular
  - Quadritubercular

- 52. A transverse ridge in maxillary first molar is formed by**
- Triangular ridge of mesiobuccal cusp and the mesial triangular ridge of the mesiopalatal cusp
  - Triangular ridge of distobuccal cusp and triangular ridge of mesiopalatal cusp
  - Triangular ridge of mesiobuccal cusp and triangular ridge of distopalatal cusp
  - None of the above
- 53. A deep concavity on the mesial surface of the crown in cervical area is present in maxillary**
- First premolar
  - First molar
  - Second premolar
  - Second molar
- 54. A deep concavity on the distal surface of the crown in the cervical area is present in the maxillary**
- First molar
  - Canine
  - Incisors
  - First PM
- 55. The two major fossa of permanent maxillary first M as**
- M and D triangular fossa
  - Central fossa and distal fossa
  - Central fossa and mesial fossa
  - Mesial fossa and mesial triangular fossa
- 56. Which furcation of roots in permanent maxillary first molar is closer to cervical line?**
- Mesial
  - Distal
  - Buccal
  - Palatal
- 57. The tooth which has longest root trunk from buccal view is**
- Maxillary 1st molar
  - Maxillary 2nd molar
  - Mandibular 1st molar
  - Mandibular 2nd molar
- 58. Which of the following is most likely to show an anomaly in radicular morphology?**
- Maxillary canine
  - Maxillary third molar
  - Maxillary first molar
  - Mandibular first molar
- 59. The occlusal outline of a permanent mandibular first molar is usually**
- Square
  - Parallelogram
  - Circle
  - Trapezoid
- 60. The maxillary molar crown of early primates has trigon of three cusps namely**
- Mesiobuccal, mesiopalatal, distobuccal
  - Mesiobuccal, mesiopalatal, distopalatal
  - Distobuccal, distopalatal, mesiopalatal
  - None of the above
- 61. The crown formation of all permanent teeth except third molars is completed between**
- 2–3 years
  - Birth to 6 years
  - Birth to 8 years
  - Birth to 12 years
- 62. In carving an occlusal amalgam restoration in a permanent mandibular second molar, the shape of the groove pattern is**
- H
  - +
  - U
  - Y
- 63. In a molar, the root canals usually join the pulp chamber**
- At the level of the furcation
  - At varying levels, depending on age
  - Within the cervical third of the crown
  - Apical to the cemento-enamel junction
- 64. The root of permanent maxillary first molar that is flattened mesiodistally and has depressions on both its mesial and distal surfaces is the**
- Palatal
  - Distobuccal
  - Mesiobuccal
  - Distopalatal

65. From occlusal aspect, the greatest bucco-palatal dimension of a permanent mandibular second molar crown is located in the
- Mesial half
  - Distal half
  - Middle
  - None
66. Cross-section of the floor of the pulp chamber is triangular in
- Permanent maxillary molars
  - Permanent mandibular first molar
  - Permanent mandibular second molar
  - None
67. When a fourth root canal is present in a maxillary first molar it is most likely located in the
- Palatal root
  - Mesiobuccal root
  - Distobuccal root
  - Distopalatal root
68. The smallest pulp horn in permanent mandibular first molar is
- Distal
  - Mesiobuccal
  - Distobuccal
  - Distopalatal
69. The statement which is correct regarding permanent mandibular first molar is
- It has four root canals
  - Mesial root has concavities on both mesial and distal surfaces
  - Distal root has concavities on both buccal and palatal sides
  - No concavities seen on any root.
70. The pulp horn most commonly exposed in cavity preparation on newly erupted permanent molar is
- ML and MB
  - DL and DB
  - DL and ML
  - None of the above
71. The tooth having five pulp horns and three root canals is most likely to be
- Maxillary first molar
  - Mandibular first molar
  - Mandibular second molar
  - Maxillary second molar
72. The three root canals of mandibular first molars are
- MB, ML, and distal
  - Mesial, distal, and palatal
  - MB, DB, and palatal
  - DL, ML, and buccal
73. The occlusal outlines of the permanent posterior teeth is correctly matched in the following:
- Mandibular second premolar—square
  - Mandibular first molar—trapezoid
  - Maxillary first molar—rhomboidal
  - All of the above
74. The statement not true about the molars is
- Mandibular molar crowns are tilted palatally
  - Palatal cusp on mandibular molars are almost equal in size.
  - Mandibular molars are wider mesio-distally
  - Maxillary molar crowns are titled palatally.
75. The most constant feature that differentiates maxillary first, second, and third molars is
- The size of the DL cusp
  - Number of roots
  - Cusp of Carabelli
  - The shape of the crown
76. Maxillary molar can be differentiated from mandibular molar by all of the following except
- Number of roots
  - Number of cusps
  - Arrangement of roots
  - All of the above
77. The statement not true about the occlusal morphology of mandibular first molars is
- Buccal cusps are functional
  - Palatal cusps are non-functional
  - MB cusp is the widest
  - Presence of oblique ridge

- 78. The permanent molar having similar occlusal morphology to mandibular third molar is**
- Mandibular first
  - Maxillary first
  - Mandibular second
  - Maxillary second
- 79. The two major fossa, of maxillary first molar are**
- M and D triangular fossa
  - Central and distal fossa
  - Central and mesial fossa
  - Mesial and mesial triangular fossa
- 80. The permanent tooth with occlusal surface characterized by five cusps, three primary and two secondary; two major and two minor fossa, four triangular ridges and one oblique ridge is**
- Maxillary first molar
  - Maxillary second molar
  - Mandibular second
  - Mandibular second
- 81. The permanent tooth with occlusal surface characterized by five cusps, one major and two minor fossa and five triangular ridges is**
- Mandibular first molar
  - Mandibular second molar
  - Maxillary first molar
  - Maxillary second molar
- 82. The furcation in permanent maxillary first molar is closest to cervical line on**
- Mesial
  - Distal
  - Buccal
  - Palatal
- 83. The longest root trunk from buccal aspect is seen in**
- Maxillary first molar
  - Maxillary second molar
  - Mandibular first molar
  - Mandibular second molar

# Differences between Deciduous and Permanent Dentition

## LAQs (10 Marks)

**Q 1. Differences between deciduous and permanent dentition.** (Oct. 2003, June 2010)

**Ans. Differences are macroscopic and microscopic or histological:**

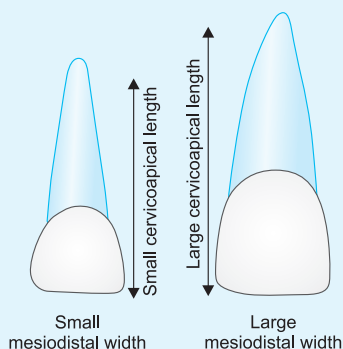
### Macroscopic (SAQ 2000, 2001, Nov. 2014)

#### Deciduous dentition

#### Permanent dentition

#### I. General features

##### 1. Number and size of teeth



- The jaws are smaller in size and number of teeth are less. A total of 20 teeth, 10 in each jaw.
- Teeth are smaller in size.
- Crown of second molar is larger than crown of first molar.
- The jaws are larger. The number of teeth are 32 with 16 teeth in each jaw.
- Teeth are larger in size than the deciduous teeth.
- Crown of first molar is larger than that of the second and third molar.

##### 2. Classes of teeth and dental formula

- There are 3 classes of teeth. Incisors, canines and molars. Premolars and third molars are not present.
- Molars are distal to canines. Dental formula is:  

$$I \frac{2}{2}, C \frac{1}{1}, M \frac{2}{2}$$
- Total of 10 teeth, 5 in upper and 5 in lower jaw. Dental Formula is written for one side of the mouth.
- There are 4 classes of teeth. Incisors, canines, premolars, and molars.
- Molars are distal to premolars. Dental formula is:  

$$I \frac{2}{2}, C \frac{1}{1}, P \frac{2}{2}, M \frac{3}{3}$$
- Total of 16 teeth, 8 in upper and 8 in lower jaw. Dental formula is written for one side of the mouth only.

(Contd.)

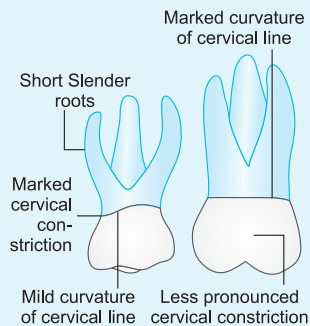
Macroscopic (SAQ 2000, 2001, Nov. 2014) (Contd.)		
	<i>Deciduous dentition</i>	<i>Permanent dentition</i>
3. Colour	<ul style="list-style-type: none"> <li>Teeth are lighter in colour. They appear bluish white (milky white) and are also called as <b>milk-teeth</b>. Their refractive index is comparable to that of milk. The enamel is opaque and less mineralized.</li> </ul>	<ul style="list-style-type: none"> <li>Teeth are darker in colour. They appear yellowish white or grayish white. Enamel is highly mineralized and translucent therefore reflects the yellowish white colour of the underlying dentin.</li> </ul>
4. Placement in the jaw	<ul style="list-style-type: none"> <li>Teeth are arranged perpendicular to the jaw.</li> </ul>	<ul style="list-style-type: none"> <li>Teeth are not perpendicular to the jaw, but are labially inclined which allows to accommodate the larger permanent teeth.</li> </ul>
5. Interdental spacing	<ul style="list-style-type: none"> <li>Interdental spacing is present which is physiological or developmental spacing.</li> </ul>	<ul style="list-style-type: none"> <li>No spacing present. If present it is due to decay or loss of tooth.</li> </ul>
6. Duration of dentition and period of eruption	<ul style="list-style-type: none"> <li>Deciduous dentition period lasts from 6 months to 6 years. Six years to 12 years is mixed dentition period.</li> <li>Total period of eruption is from 6 months to 2.5–3 years.</li> <li>Root completion is 1 year after eruption.</li> </ul>	<ul style="list-style-type: none"> <li>Permanent dentition period is from 12 years onwards.</li> <li>Period of eruption is between 6 years to 12 years except for third molars which erupt between 18–25 years.</li> <li>Root completion is 2–3 years after eruption.</li> </ul>
7. Development time	<ul style="list-style-type: none"> <li>Development time for deciduous teeth is shorter.</li> </ul>	<ul style="list-style-type: none"> <li>Development time for permanent teeth is longer.</li> </ul>
8. Sequence of eruption	<ul style="list-style-type: none"> <li>The first tooth to erupt is mandibular central incisor.</li> <li>Deciduous teeth erupt from anterior to posterior except first molar which erupts before canine.</li> <li> <math display="block">\begin{array}{c} \text{A B D C E} \\ \text{A B D C E} \end{array}</math> </li> </ul>	<ul style="list-style-type: none"> <li>The first tooth to erupt is first molar.</li> <li>Permanent teeth erupt from posterior to anterior.</li> <li> <math display="block">\begin{array}{c} \text{6 1 2 4 5 3 7 8} \\ \text{6 1 2 3 4 5 7 8} \end{array}</math> </li> </ul>
9. Shedding	<ul style="list-style-type: none"> <li>Shedding is physiological.</li> <li>Teeth start exfoliating from about 7–10 years due to physiologic resorption of roots.</li> </ul>	<ul style="list-style-type: none"> <li>Shedding or loss of teeth is due to some pathology.</li> </ul>
10. Mineralization	<ul style="list-style-type: none"> <li>The teeth are less mineralized therefore, wear out faster.</li> </ul>	<ul style="list-style-type: none"> <li>Teeth are highly mineralized.</li> </ul>

(Contd.)

## Macroscopic (SAQ 2000, 2001, Nov. 2014) (Contd.)

## II. Crown morphology

## 11. Shape and cervical constriction



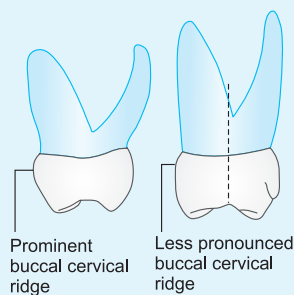
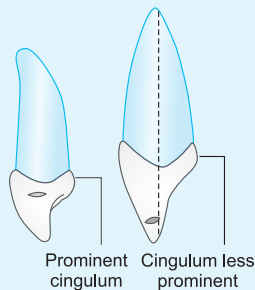
## Clinical significance

- **Incisors**
  - Width of the crown is more than the length.
  - More constriction at the cervix.
- The length of the crown is more than the width.
- Less constriction at the cervix.

- **Molar**
  - Molars have more bulbous shape due to more constriction at the cervix.
- Do not have bulbous shape.

- Cervical constriction has to be kept in mind while forming gingival floor during class II cavity preparation.
- Crowns of permanent teeth are not so constricted at the cervix.

## 12. Surface and cingulum and cervical ridge



## Incisors

- In incisors the surface is flat above the cervical ridge.
- There are no developmental depressions on the labial surface.
- Cervical ridge on labial surface of anterior teeth is very prominent.
- Cingulum is more prominent.
- In incisors, the surface above the height of contour is slightly convex.
- Transient developmental grooves separating the mamelons are present on the labial surface.
- No prominent cervical ridge
- Comparatively cingulum is less prominent.

## Molars

- In molars also the surface is flat above the cervical ridge up to the occlusal.
- Cervical ridge on the buccal surface of molar is very prominent, especially on buccal surface of first molars. If overdeveloped, it is referred to as "tubercle of zuckerkandl" or buccal cingulum.
- In molars the surfaces are convex above the cervical ridge up to the occlusal.
- Cervical ridges are not prominent except in mandibular second molars.

## 13. Mamelons

- No mamelons in newly erupted incisors.
- Mamelons are present on the incisal ridge of the newly erupted incisors.

## 14. Cervical line

- Cervical line is less curved.
- It is more curved.

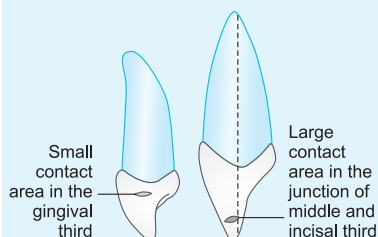
(Contd.)



### Deciduous dentition

### Permanent dentition

### Clinical significance



- Contacts areas between teeth are flatter, broader and situated gingivally.
- While preparing class II cavity, buccal and lingual walls should be made divergent.
- Contact areas between permanent teeth are narrower and situated either in the middle third or at the junction of incisal and middle third.

## 16. Molar

- Upper first molar has 3–4 cusps, it resembles a premolar.
- Upper second molar has four cusps and one accessory cusp, the cusp of Carabelli. It resembles permanent upper first molar.
- Lower first molar has four cusps (it does not resemble any permanent tooth).
- Lower second molar has five-cusps (it resembles permanent lower first molar.)
- Upper first molar has four cusps and accessory cusp the cusp of Carabelli.
- Upper second molar has four cusps or three cusps.
- Lower first molar has five cusps.
- Lower second molar has four cusps.

### Relation between distal planes of last molars

- Mesiodistal relation between distal surfaces of upper and lower second molars is called the **terminal plane**.
- Distal surfaces of upper and lower second molars are in one vertical plane due to a greater mesiodistal width of lower second molar and is called **Flush-terminal plane** or end-on-occlusion which is necessary for normal eruption and occlusion of permanent first molar.
- There is no such distal plane relation in permanent molar.

## Cusps

- The cusps are short and sharp
- The cusps are less sharp.

## Occlusal surface

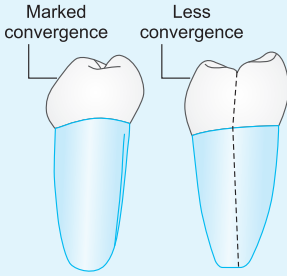
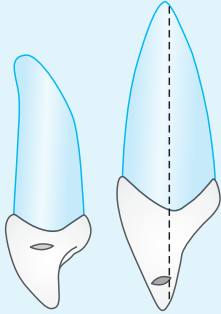
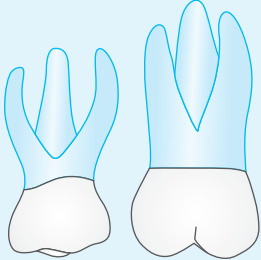
- Since the cusps are short and the fossae and ridges are less prominent the occlusal surface is shallow.
- Due to longer cusps and more prominent fossae and ridges the occlusal surface is deeper and has curved contour.

## Grooves

- More supplemental grooves due to which more prone to caries. To prevent caries, pit and fissure sealants are advisable.
- Fewer supplemental grooves.

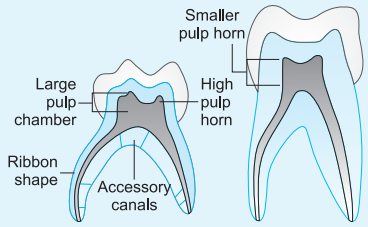
(Contd.)

**Macroscopic (SAQ 2000, 2001, Nov. 2014) (Contd.)**

	<i>Deciduous dentition</i>	<i>Permanent dentition</i>
<b>Occlusal table area</b> 	<ul style="list-style-type: none"> <li>Buccal and lingual surfaces converge sharply occlusally, thus forming a narrow occlusal table area buccolingually.</li> <li>Deciduous molars are functionally adapted to withstand less occlusal load.</li> </ul>	<ul style="list-style-type: none"> <li>There is less convergence of buccal and lingual surface towards occlusal thus occlusal table appears wider buccolingually.</li> </ul>
<b>Clinical significance</b>	<ul style="list-style-type: none"> <li>Occlusal cavity preparation should be kept narrow buccolingually.</li> </ul>	
<b>III. Root morphology</b>		
<b>17. Length and width</b>	<ul style="list-style-type: none"> <li>Roots of deciduous teeth are shorter and slender and they are narrower mesiodistally.</li> </ul>	<ul style="list-style-type: none"> <li>Roots are longer and stronger and they are broader mesiodistally.</li> </ul>
<b>18. Crown root ratio</b>	<ul style="list-style-type: none"> <li>In deciduous teeth, the roots are longer in proportion to the crown size.</li> </ul>	<ul style="list-style-type: none"> <li>Roots are not as long in proportion to the crown size.</li> </ul>
<b>19. Inclination of the root</b> 	<ul style="list-style-type: none"> <li>The roots of the anterior teeth have a slight labial inclination of about 10° in the apical third to accommodate the developing permanent anterior teeth.</li> </ul>	<ul style="list-style-type: none"> <li>The roots do not show any labial inclination.</li> </ul>
<b>20. Root trunk and furcation</b> 	<ul style="list-style-type: none"> <li>The furcation of the roots of molars is near the cervical line so that the root trunk is almost absent.</li> </ul>	<ul style="list-style-type: none"> <li>The furcation of the root is more apically placed, thus the root trunk is longer.</li> </ul>

(Contd.)

**Macroscopic (SAQ 2000, 2001, Nov. 2014) (Contd.)**

	<i>Deciduous dentition</i>	<i>Permanent dentition</i>
<b>21. Flaring of roots in molars</b>	<ul style="list-style-type: none"> <li>Roots of deciduous molars flare out markedly to accommodate the developing premolars.</li> </ul>	<ul style="list-style-type: none"> <li>Roots of permanent molars do not flare markedly.</li> </ul>
<b>Clinical significance</b>	<ul style="list-style-type: none"> <li>Thin, slender and flared roots with absence of root trunk may cause fracture during extraction.</li> </ul>	
<b>22. Apical foramen and resorption</b>	<ul style="list-style-type: none"> <li>The apical foramen is larger.</li> <li>Roots undergo physiologic resorption. Pathological resorption is less common.</li> </ul>	<ul style="list-style-type: none"> <li>It is narrower.</li> <li>Physiologic resorption is absent. Pathological resorption is commonly seen.</li> </ul>
<b>IV. Pulp morphology</b>		
<b>23. Pulp chamber</b>	<ul style="list-style-type: none"> <li>Pulp chamber is larger as compared to the crown size.</li> </ul>	<ul style="list-style-type: none"> <li>Pulp chamber is smaller as compared to the crown size.</li> </ul>
<b>24. Pulp horns</b>	<ul style="list-style-type: none"> <li>Pulp horns of molars (especially, mesial horns) are higher and close to the outer surface than that of permanent molars.</li> </ul>	<ul style="list-style-type: none"> <li>Pulp horns are lower and away from the outer surface.</li> </ul>
		
<b>Clinical significance</b>	<ul style="list-style-type: none"> <li>Pulp horns more longer and pointed than cusps would indicate.</li> <li>Care should be taken during cavity preparation to prevent pulp exposure.</li> </ul>	
<b>25. Pulp canals</b>	<ul style="list-style-type: none"> <li>Root canals are flat, ribbon shaped, more tortuous and branching which makes complete debridement impossible.</li> </ul>	<ul style="list-style-type: none"> <li>Root canals are well-defined and less branching.</li> </ul>
<b>26. Accessory canals</b>	<ul style="list-style-type: none"> <li>Accessory pulp canals are more in number and found in furcation area.</li> <li>Floor of the pulp chamber is more porous due to which the inflammation can directly reach periodontium.</li> </ul>	<ul style="list-style-type: none"> <li>Accessory canals are found near the apex of the root.</li> </ul>

**Q 2. Explain histologic/microscopic differences.**

(Nov. 2004)

**Ans.**

	<i>Deciduous dentition</i>	<i>Permanent dentition</i>
<b>1. Enamel</b>		
<b>Thickness</b>	<ul style="list-style-type: none"> <li>Enamel is thinner but of uniform thickness. (1 mm) decay progresses faster to the pulp.</li> </ul>	<ul style="list-style-type: none"> <li>Enamel is thick (2–3 mm) and not uniform in thickness.</li> </ul>
Clinical significance	<ul style="list-style-type: none"> <li>Depth of the cavity should be less and less pressure required during cavity preparation.</li> </ul>	
<b>Mineralization</b>	<ul style="list-style-type: none"> <li>Enamel is less mineralized thus wears out faster. It is more permeable.</li> </ul>	<ul style="list-style-type: none"> <li>Enamel is more mineralized.</li> </ul>
Clinical significance	<ul style="list-style-type: none"> <li>Greater permeability facilitates better uptake of fluoride in caries preventive measures.</li> </ul>	
<b>Direction of enamel rods</b>	<ul style="list-style-type: none"> <li>In the cervical region the enamel rods are directed occlusally from DEJ to the enamel surface.</li> </ul>	<ul style="list-style-type: none"> <li>In the cervical region the enamel rods are directed gingivally.</li> </ul>
<b>Incremental lines</b>	<ul style="list-style-type: none"> <li>Incremental lines of Retzius are less common.</li> </ul>	<ul style="list-style-type: none"> <li>Lines of Retzius are more common.</li> </ul>
<b>Neonatal line</b>	<ul style="list-style-type: none"> <li>Neonatal line is present in all deciduous teeth.</li> </ul>	<ul style="list-style-type: none"> <li>Neonatal line is present in first molar only.</li> </ul>
<b>2. Dentin</b>		
<b>Thickness</b>	<ul style="list-style-type: none"> <li>Dentin is thin and of variable thickness, increased thickness near occlusal fossa area.</li> </ul>	<ul style="list-style-type: none"> <li>Dentin is thick and is of more uniform thickness.</li> </ul>
<b>Dentinal tubules</b>	<ul style="list-style-type: none"> <li>Dentinal tubules are less regular.</li> </ul>	<ul style="list-style-type: none"> <li>Dentinal tubules more regular.</li> </ul>
<b>Secondary dentin</b>	<ul style="list-style-type: none"> <li>Less deposition of secondary dentin.</li> </ul>	<ul style="list-style-type: none"> <li>Greater deposition of secondary dentin.</li> </ul>
<b>Interglobular dentin</b>	<ul style="list-style-type: none"> <li>Interglobular dentin is absent.</li> </ul>	<ul style="list-style-type: none"> <li>Interglobular dentin is present beneath the well-calcified mantle dentin.</li> </ul>
<b>Neonatal line</b>	<ul style="list-style-type: none"> <li>Neonatal line is present in all deciduous teeth.</li> </ul>	<ul style="list-style-type: none"> <li>Neonatal line present only in first molar.</li> </ul>
<b>Mineralization</b>	<ul style="list-style-type: none"> <li>It is less mineralized and softer.</li> </ul>	<ul style="list-style-type: none"> <li>It is more mineralized and harder.</li> </ul>
<b>DEJ</b>	<ul style="list-style-type: none"> <li>Dentinoenamel junction is not scalloped.</li> </ul>	<ul style="list-style-type: none"> <li>Dentinoenamel junction is scalloped.</li> </ul>
<b>3. Cementum</b>		
<b>Thickness</b>	<ul style="list-style-type: none"> <li>Cementum is relatively thin and made-up of only primary cementum. Anchorage is less firm.</li> </ul>	<ul style="list-style-type: none"> <li>Cementum is relatively thick. Both cellular and acellular cementum present. Cellular cementum being thicker in the apical region.</li> </ul>

(Contd.)

	<i>Deciduous dentition</i>	<i>Permanent dentition (Contd.)</i>
<b>CDJ</b>	<ul style="list-style-type: none"> <li>• Cementodentinal junction is scalloped.</li> </ul>	<ul style="list-style-type: none"> <li>• Cementodentinal junction is not scalloped.</li> </ul>
<b>4. Pulp</b>		
<b>Pulp chamber</b>	<ul style="list-style-type: none"> <li>• Pulp chamber is proportionately larger.</li> </ul>	<ul style="list-style-type: none"> <li>• Pulp chamber is smaller in proportion to the crown size.</li> </ul>
<b>Pulp horns</b>	<ul style="list-style-type: none"> <li>• Pulp horns are pointed and at a higher level especially the mesial pulp horns.</li> <li>• Hence care should be taken during cavity preparation to prevent pulp exposure.</li> </ul>	<ul style="list-style-type: none"> <li>• Pulp horns are lower and not as pointed.</li> </ul>
<b>Accessory canals</b>	<ul style="list-style-type: none"> <li>• Accessory canals are present in furcation area.</li> </ul>	<ul style="list-style-type: none"> <li>• Accessory canals are more near the apex of the root.</li> </ul>
<b>Apical foramen</b>	<ul style="list-style-type: none"> <li>• Apical foramen larger, thus abundant blood supply and exhibit a more typical inflammatory response.</li> <li>• Poor localization of infection and inflammation.</li> </ul>	<ul style="list-style-type: none"> <li>• Apical foramen is narrower.</li> </ul>
<b>Root canals</b>	<ul style="list-style-type: none"> <li>• Root canals flatter.</li> </ul>	<ul style="list-style-type: none"> <li>• Root canals are round or oval or triangular.</li> </ul>
<b>Nerves</b>	<ul style="list-style-type: none"> <li>• Pulp is less innervated thus primary teeth are less sensitive to operative procedure.</li> </ul>	<ul style="list-style-type: none"> <li>• Pulp is densely innervated.</li> </ul>
<b>5. PDL</b>	<ul style="list-style-type: none"> <li>• Periodontal space is wider.</li> </ul>	<ul style="list-style-type: none"> <li>• Periodontal space is narrower.</li> </ul>

### SAQs (3 Marks)

#### Q 1. Describe functions of deciduous teeth.

(July 2008)

**Ans.**

1. The deciduous teeth are useful for mechanical preparation of child's food for digestion and assimilation during one of the most active periods of growth and development.
2. They maintain space in the dental arch for the permanent teeth to erupt.
3. They stimulate the growth of jaws through mastication especially in the development of the height of the dental arches.
4. They function in the development of speech.  
Ability to use the teeth for pronunciation is acquired entirely with the aid of primary teeth. Early and accidental loss of primary anterior teeth may lead to difficulty in pronouncing the sounds f, v, s, z, th.
5. The normal facial appearance and smile of the child is maintained due to support provided by the teeth to cheeks and lips.

**Q 2. Differentiate type traits of deciduous maxillary molars.**

(Nov. 2004)

**Ans.**

<i>Maxillary first molar</i>	<i>Maxillary second molar</i>
<ul style="list-style-type: none"> <li>• It is most atypical of all molars.</li> <li>• It resembles the maxillary first premolar that replaces it.</li> <li>• It is mesial to the deciduous second molar.</li> <li>• It is the smallest deciduous molar</li> <li>• Occlusal outline is relatively flat with no definite cusp form.</li> <li>• Two buccal cusps are unequal in size and MB cusp is wider, longer and less sharp.</li> <li>• There is no cusp of Carabelli.</li> <li>• Distolingual cusp is inconspicuous.</li> </ul>	<ul style="list-style-type: none"> <li>• It resembles the permanent first molar that erupts distal to it.</li> <li>• It is larger than the first molar.</li> <li>• Occlusal outline is formed by the tips of MB and DB cusps.</li> <li>• Two buccal cusps are more equal in size.</li> <li>• Cusp of Carabelli is present.</li> <li>• DL cusp is smallest but well-developed.</li> </ul>
<b>From occlusal aspect</b>	
<ul style="list-style-type: none"> <li>• It generally has four cusp giving it quadrilateral occlusal form.</li> <li>• Two larger cusps MB and ML show premolar like form.</li> <li>• Two smaller cusps DB and DL which may be absent giving triangular occlusal form.</li> <li>• Oblique ridge is less prominent.</li> <li>• There are three fossae.</li> <li>• The central fossa, the mesial fossa is larger and smaller distal triangular fossa.</li> <li>• The central groove runs mesiodistally from mesial pit to distal pit.</li> <li>• The buccal developmental groove separates MB and DB cusps and may extend onto buccal surface.</li> <li>• The distal developmental groove separates the two lingual cusps and may or may not extend onto lingual surface.</li> <li>• Three roots are thin, slender, divergent, and visible from both buccal and lingual aspects.</li> </ul>	<ul style="list-style-type: none"> <li>• It generally has four major cusps and one minor cusp of Carabelli.</li> <li>• Occlusal form is rhomboidal.</li> <li>• Oblique ridge is well-defined prominent and straighter.</li> <li>• There are four fossae.</li> <li>• The central fossa, the mesial triangular fossa.</li> <li>• The distal fossa located distal to oblique ridge and less distinct distal triangular fossa.</li> <li>• The central groove runs from mesial pit to the central pit.</li> <li>• The buccal developmental groove separates MB and DB cusps and may extend onto buccal surface.</li> <li>• The distal developmental groove separates the two lingual cusps and extends onto the lingual surface as the lingual developmental groove.</li> <li>• Three roots are thin, slender and divergent and visible from both buccal and lingual aspects.</li> </ul>

**Q 3. Describe importance of primary teeth.**

(Nov. 2010, June 2011)

**Ans.**

- Care of primary dentition is very much essential for the normal growth and development of the jaws and establishment of the normal occlusion of permanent dentition.
- Neuromuscular coordination required for masticatory process is established at primary dentition stage.
- With the establishment of primary occlusion, child learns to masticate food efficiently.
- Functional occlusion of primary teeth helps to maintain a proper diet and good nutrition.
- A well-cared set of primary teeth helps to maintain normal facial appearance which in turn helps normal psychological development of the child.

- The primary teeth, especially the anteriors are necessary for normal pronunciation of consonants and for development of clear speech.
- The proper care of primary teeth is important to avoid infection and spread of infection.
- The primary teeth maintain the normal eruption schedule of permanent successors.
- The primary teeth help in maintaining the space for eruption of permanent successor.
- The premature loss of primary teeth due to caries or trauma causes migration of adjacent teeth into the available space leading to decrease in arch length. This causes lack of space for the erupting permanent tooth resulting in development of malocclusion.

**Q 4. What is buccal cingulum/tuberculum of Zukerkandl?**

*(Dec. 2005, May 2007)*

**Ans.**

- The cervical ridge running mesiodistally in the cervical third of the buccal surface of the primary first molars is sometimes called **buccal cingulum**. It is present in both maxillary and mandibular first molars.
- It is more prominent in the cervical third of the mesiobuccal cusp of the primary maxillary first molar and is referred to as Tuberculum of Zukerkandl. When viewed from mesial aspect, the buccal outline of the molar shows pronounced convexity of the cervical enamel ridge in the cervical third and then the buccal outline is straight line converging in an occlusal direction. This makes the occlusal table narrower buccolingually compared to that of the permanent molars.

## MULTIPLE CHOICE QUESTIONS (MCQs)

1. Divergent roots with very short root trunk is present in
  - a. Permanent maxillary molars
  - b. Permanent mandibular molars
  - c. Primary molars
  - d. All posterior teeth
2. The teeth not included in primary set are
  - a. Canines
  - b. Third molars
  - c. Premolars
  - d. Both b and c
3. The predecessor of permanent molars are
  - a. Primary first molar
  - b. Primary second molar
  - c. Primary canine
  - d. None of the above
4. Mixed dentition is present from
  - a. 1–5 years
  - b. 3–8 years
  - c. 6–12 years
  - d. 8–16 years
5. The number of teeth present in the oral cavity at the age of 8 years are
  - a. 20
  - b. 32
  - c. 24
  - d. 48
6. Primary maxillary second molars most closely resemble
  - a. Primary maxillary first molar
  - b. Permanent maxillary first molar
  - c. Permanent maxillary second molar
  - d. Primary maxillary second molar
7. The highest and sharpest cusp on a primary mandibular first molar is
  - a. Mesiolingual
  - b. Distolingual
  - c. Mesibuccal
  - d. Distobuccal
8. Primary mandibular second molars resemble
  - a. Primary mandibular first molar
  - b. Permanent mandibular second molar
  - c. Permanent mandibular first molar
  - d. None of the above
9. Man has two sets of dentition, one primary, the other permanent, this can be correctly described as
  - a. Polyphyodont
  - b. Monophyodont
  - c. Diphyodont
  - d. Homodont
10. Which tooth does not exist in primary dentition?
  - a. Incisors
  - b. Canines
  - c. Premolars
  - d. Molars
11. Primary first molars are
  - a. Larger in size than primary second molars
  - b. Much smaller in size than primary second molars
  - c. Same as primary second molars
  - d. None of the above
12. The primary teeth having strange and primitive appearance is
  - a. Maxillary 1st molar
  - b. Maxillary 2nd molar
  - c. Mandibular 1st molar
  - d. Mandibular 2nd molar
13. Primary teeth when in occlusion, each teeth occludes with two teeth of the opposing jaw except
  - a. Mandibular central incisors
  - b. Maxillary central incisors
  - c. Maxillary second molar
  - d. Both a and c
14. Primary teeth are worn off rapidly on incisal edges and occlusal surfaces because
  - a. Of food habits
  - b. Of brittle teeth
  - c. Teeth do not hold their relative positions for long-time
  - d. All the above

1-c, 2-d, 3-d, 4-c, 5-c, 6-b, 7-a, 8-c, 9-c, 10-c, 11-b, 12-c, 13-d, 14-c



- 15. The human dentition is referred to as**
- Omnivorous dentition
  - Carnivorous dentition
  - Herbivorous dentition
  - All the above
- 16. The groove that separates the gumpads from the palate and floor of the mouth is**
- Gingival groove
  - Dental groove
  - Transverse groove
  - Mesiogingival groove
- 17. Even though upper and lower gumpads are almost similar to each other the upper gum pad is**
- Wider and longer than the lower
  - Narrower and shorter than the lower
  - Wider and shorter than the mandibular gum pad
  - Narrower and longer than lower
- 18. When upper and lower gum pads are approximated**
- There is complete over jet all around
  - Contact occurs only at first molar region
  - Space exists between them in anterior region
  - Infantile open bite is normal and helps suckling
  - All of above
- 19. The spaces between the deciduous teeth are called**
- Normal and physiological spaces or developmental spaces
  - Abnormal spaces
  - Diastema
  - Leeway space
- 20. The location and relationship of the first permanent molar depends much upon**
- Mesial surface relationship between upper and lower first deciduous molars
  - Distal surface relationship between upper and lower second deciduous molars
  - Both a and b
  - None of the above
- 21. Leeway space of Nance is the difference between the combined MD width of**
- C, D, E and 3, 4, 5
  - C, D, E and 4, 5, 6
  - A, B, C and 1, 2, 3
  - C, D, E and 5, 6, 7
- 22. The Leeway space on each side of the maxillary and mandibular arch is**
- 1.8 mm and 3.4 mm
  - 0.9 mm and 1.7 mm
  - 0.5 mm and 0.9 mm
  - 0.2 mm and 0.5 mm
- 23. When thickness of dentin in primary teeth is compared with that of permanent teeth the dentin in primary teeth is about**
- One-fourth of the thickness of permanent teeth
  - Half of the thickness of the permanent teeth
  - Two-thirds of the thickness of the permanent teeth
  - One-sixth of the thickness of the permanent teeth
- 24. The pulp horn which is more likely to be exposed during cavity preparation on deciduous molars is**
- Mesiobuccal of first molar
  - Distobuccal of first molar
  - Mesiobuccal of second molar
  - Distobuccal of second molar
- 25. In general, first deciduous tooth to erupt in oral cavity is**
- Mandibular central incisor
  - Maxillary central incisor
  - Mandibular first molar
  - Maxillary second molar

- 26. Mixed dentition period in an average child is between**  
a. 10 years to 15 years of age  
b. 6 years to 13 years of age  
c. 4 years to 13 years of age  
d. 15 years to 17 years of age
- 27. Generally the sequence of eruption of permanent teeth in maxilla is**  
a. 1 – 6 – 2 – 3 – 4 – 7 – 5 – 8  
b. 6 – 1 – 2 – 4 – 3 – 5 – 7 – 8  
c. 6 – 1 – 2 – 3 – 4 – 5 – 7 – 8  
d. 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8
- 28. In deciduous dentition, the tooth which is more wider mesiodistally is**  
a. Maxillary first molar  
b. Mandibular first molar  
c. Maxillary second molar  
d. Mandibular second molar
- 29. Generally the sequence of eruption of permanent teeth in lower jaw is**  
a. 1 – 6 – 2 – 3 – 5 – 4 – 7 – 8  
b. 6 – 1 – 2 – 4 – 5 – 3 – 7 – 8  
c. 6 – 1 – 2 – 3 – 4 – 5 – 7 – 8  
d. 1 – 7 – 6 – 5 – 4 – 3 – 2 – 8
- 30. The permanent tooth which succeeds the deciduous first molar is**  
a. First premolar  
b. First molar  
c. Second premolar  
d. Second molar
- 31. Abscess from a primary tooth can cause dark spot on the underneath permanent developing tooth is called**  
a. White spot    b. Black spot  
c. Turner's spot    d. None of the above
- 32. Calcification of the primary teeth begins *in utero***  
a. 18–20 weeks  
b. 15–18 weeks  
c. 13 and 16 weeks  
d. 6–10 weeks
- 33. The general order of eruption of primary dentition is**  
a. A – B – C – D – E  
b. D – A – B – C – E  
c. A – B – D – C – E  
d. B – A – C – D – E
- 34. The process of exfoliation of the primary teeth takes place during**  
a. 5th and 10th year  
b. 6th and 14th year  
c. 7th and 12th year  
d. 8th and 11th year
- 35. The primary teeth remain in normal alignment and occlusion for**  
a. 6 years                      b. 5 years  
c. 4 years                      d. 3 years
- 36. In primary dentition, the canine which has its mesial cusp slope longer than the distal cusp slope is**  
a. Primary maxillary canine  
b. Primary mandibular canine  
c. Both the above  
d. None of the above
- 37. Which of the following is not a succedaneous tooth**  
a. Permanent first molar  
b. Permanent third molar  
c. Permanent second molar  
d. All of the above
- 38. Zukerkandl tubercle is present on**  
a. Deciduous first molar  
b. Deciduous second molar  
c. Deciduous canine  
d. Deciduous incisors
- 39. The primary molar having a prominent transverse ridge that unites the mesio-facial and mesiolingual cusps is**  
a. First mandibular molar  
b. Second mandibular molar  
c. First maxillary molar  
d. Second maxillary molar

- 40. Primary maxillary canine exfoliates at the age of**  
a. 6–7 years      b. 7–8 years  
c. 9–10 years      d. 10–11 years
- 41. Resorption of roots of primary molars begins at the age of**  
a. 5 years      b. 4 years  
c. 3 years      d. 2 years
- 42. The last succedaneous tooth to erupt in mouth is**  
a. Maxillary second molar  
b. Maxillary first molar  
c. Maxillary canine  
d. Maxillary first premolar
- 43. Generally permanent maxillary central incisors has**  
a. Three mamelons and two developmental lobes  
b. Two mamelons and two developmental lobes  
c. Three mamelons and four developmental lobes  
d. Three mamelons and three developmental lobes
- 44. An approximation of the curvature of the circles of a 4-inch equilateral triangle was given by**  
a. Von Spee      b. Monson  
c. Bolton      d. Bonwill
- 45. Under normal condition the presence of mamelons in a 14-year-old patient is indicative of**  
a. Malnutrition      b. Fluorosis  
c. Malocclusion      d. Malformation
- 46. A transverse ridge is prominently present on the following primary molar**  
a. Maxillary first molar  
b. Maxillary second molar  
c. Mandibular first molar  
d. Mandibular second molar
- 47. Calcification of the roots of primary teeth is normally completed between**  
a. 1–2 years      b. 3–4 years  
c. 5–6 years      d. 7–8 years
- 48. The primary molar in which the mesial portion of the occlusal table is separated from the remainder by a transverse ridge is**  
a. Maxillary first molar  
b. Mandibular first molar  
c. Mandibular second molar  
d. None
- 49. The dentition of a normally developed 6½-year old child usually consists of**  
a. 8 primary and 8 permanent teeth  
b. 10 primary and 10 permanent teeth  
c. 18 primary and 6 permanent teeth  
d. 20 primary teeth
- 50. A one-year old child is expected to have the following maxillary and mandibular teeth**  
a. Incisors and canines  
b. Incisors and first molars  
c. Central incisors and canines  
d. Mandibular central and lateral incisors
- 51. The highest and sharpest cusp on the deciduous mandibular first molar**  
a. Mesio Buccal      b. Distobuccal  
c. Mesiolingual      d. Distolingual
- 52. The primary teeth that present the most outstanding morphological deviation from permanent teeth are**  
a. Central incisors  
b. Lateral incisors  
c. Canines  
d. First molars
- 53. The primary mandibular second molars have**  
a. 2 cusps      b. 3 cusps  
c. 4 cusps      d. 5 cusps

40-d, 41-b, 42-c, 43-c, 44-d, 45-c, 46-c, 47-b, 48-b, 49-c, 50-b, 51-c, 52-d, 53-d

54. The lingual surface of primary maxillary central incisors closely resembles that of  
a. Mandibular lateral incisor  
b. Maxillary canine  
c. Mandibular lateral incisor  
d. Mandibular central incisor
55. Initial calcification of primary teeth occurs before birth in the following  
a. Incisors  
b. Canines  
c. Molars  
d. All of the above
56. Hypoplasia of primary teeth limited to incisal or occlusal one-third indicates  
a. Flouridated water  
b. Tetracycline medication  
c. Metabolic disturbance  
d. Dentinogenesis imperfecta
57. The deciduous molar which has greatest resemblance to a premolar is  
a. Maxillary first molar  
b. Maxillary second molar  
c. Mandibular first molar  
d. Mandibular second molar
58. The developmental space or primate space in mandibular arch is present between  
a. Canine and first molar  
b. First and second molar  
c. Lateral incisor and canine  
d. Central and lateral incisor
59. The occlusal outline of the primary mandibular first molar  
a. Rhomboidal  
b. Trapezoidal  
c. Diamond shaped  
d. Rectangular
60. Number of grooves present on the occlusal surface of primary mandibular first molar are  
a. 4  
b. 6  
c. 3  
d. 8
61. The outline of the labial surface of deciduous maxillary canine  
a. Diamond shaped  
b. Rhomboidal  
c. Angular  
d. Both a and c
62. Occlusal outline seen in deciduous maxillary first molar  
a. Two-cusp type  
b. Three-cusp type  
c. Four-cusp type  
d. Both b and c
63. The primary mandibular left canine according to universal numbering system is written as  
a. R  
b. M  
c. 73  
d. 83
64. Cusp of Carebelli is seen in the  
a. Deciduous maxillary first molar  
b. Deciduous maxillary second molar  
c. Permanent maxillary first molar  
d. Both b and c
65. The number of teeth in deciduous dentition and permanent dentition are  
a. 31 and 20  
b. 20 and 32  
c. 52 and 20  
d. 20 and 52
66. The deciduous teeth are white in colour because  
a. Enamel is less mineralized  
b. Enamel does not reflect the colour of the underlying dentin  
c. Enamel is opaque  
d. All of the above
67. The degree of labial bend in the apical third of the roots of the deciduous anterior teeth is  
a. 20°  
b. 12°  
c. 10°  
d. 8°

54-b, 55-d, 56-c, 57-a, 58-a, 59-a, 60-a, 61-d, 62-d, 63-b, 64-d, 65-b, 66-d, 67-c

- 68. The level of furcation of the roots of the deciduous teeth is**  
a. 4 mm from cervix  
b. 3 mm from cervix  
c. Near the cervix  
d. Both a and c
- 69. In deciduous teeth the accessory pulp canals are situated at the**  
a. Apical region  
b. Furcation  
c. Middle third  
d. All
- 70. Initial calcification of which of the primary teeth occurs before birth**  
a. Incisors                      b. Canines  
c. Molars                        d. All of the above
- 71. In the sequence of eruption of permanent dentition, the maxillary canine usually follows**  
a. Maxillary LI  
b. Mandibular 1st PM  
c. Mandibular 2nd PM  
d. Mandibular canine
- 72. The crown formation of all the permanent teeth except third molars is completed between**  
a. 2–3 years  
b. Birth to 6 years  
c. Birth to 8 years  
d. Birth to 12 years
- 73. Root development of permanent dentition except third molar is completed by**  
a. 12 years  
b. 14 years  
c. 16 years  
d. 18 years
- 74. The lingual surface of primary maxillary CI closely resembles that of**  
a. Maxillary lateral incisor  
b. Maxillary canines  
c. Mandibular LI  
d. Mandibular CI
- 75. The primary second molars have**  
a. 2 cusps                      b. 3 cusps  
c. 4 cusps                      d. 5 cusps

# Occlusion

## LAQ (10 Marks)

**Q 1. Define occlusion. Describe factors governing occlusion.** (Nov. 2004, 2014, June 2016)

**Ans.** Occlusion is derived from the Latin word *Occlude* meaning “to close”.

### Definition

- It is defined as the contact relationship of the teeth in function and parafunction.
- In addition to the contact at an occlusal interface, occlusion is also concerned with other factors associated with the development and stability of the masticatory system and with the use of teeth in oral motor behavior.

### *Factors influencing occlusion*

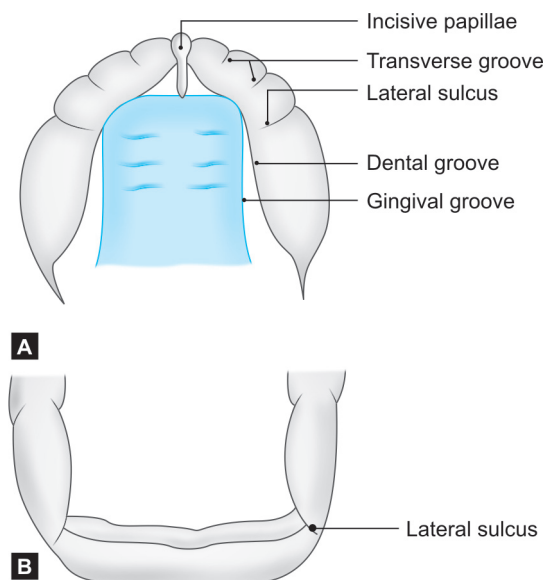
1. Development of the dentition.
2. Dental arch form.
3. Curvatures of occlusal planes.
4. Inclination and angulation of the roots of the teeth.
5. Functional form of the teeth at incisal and occlusal thirds.
6. Facial and lingual relations of each tooth in one arch to its antagonists in the opposing arch in centric occlusion (overlap of the teeth).
7. Occlusal contacts and intercuspal relations between arches.
8. Occlusal contact relations and intercuspal relations of the teeth.
9. Neurobehavioral aspects of occlusion.

## 1. DEVELOPMENT OF THE DENTITION

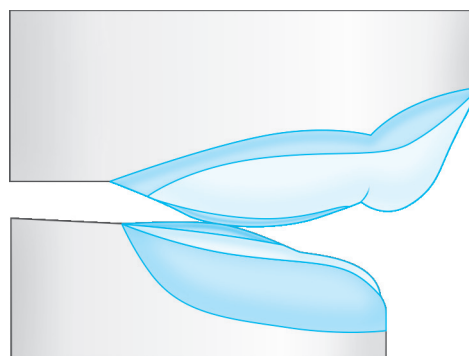
The different periods of dentition are pre-dentition period, deciduous dentition period, mixed dentition period, and permanent dentition.

### Pre-dentition Period (Figs 7.1 and 7.2)

- This period is the time from birth to 6 months (till the first deciduous tooth erupts).
- The dental arches during this period are referred to as gum pads. These are pink, firm and covered by a dense layer of fibrous periosteum.



**Figs 7.1A and B:** (A) Upper gum pad; (B) Lower gum pad



**Fig. 7.2:** Gum pads in occlusion

- The upper gum pads are wider than the lower gum pads.
- Upper and the lower gum pads are U-shaped.
- The contact between the gum pads occur in the first molar region with absence of contact at the anterior region of the jaws. This spacing is physiologic and aids the infant in suckling.
- This period ends when first deciduous tooth erupts and period of deciduous dentition begins.

#### Clinical Implications

**Natal and neonatal teeth:** These refer to the teeth that erupt prematurely before their normal eruption time. Natal teeth are those which erupt before 30 days of birth and neonatal teeth are referred to those teeth that erupt between 30 days to 6 months. The natal and neonatal teeth are usually present in the mandibular region and interfere with suckling and hence have to be managed appropriately.

#### Deciduous Primary Dentition

- This period extends from 6 months of age when the deciduous mandibular incisors erupt till 6 years of age when permanent first molar erupts.
- The primary teeth are arranged in the form of two arches; maxillary and mandibular and outline is roughly elliptical when following the labial and buccal surface which is wider in the maxillary arch than the mandibular arch.
- Time taken for eruption of deciduous teeth: 6 months to 2 and half-year and root formation is completed by 3 years of age.
- Sequence of eruption: A B D C E.
- **Interdental spacing:** (Fig. 7.3)
  - After the deciduous teeth are fully formed and occupy their respective position, rapid development of the jaws results in interdental spacing between the teeth. These spaces between the teeth are referred to as **physiological spaces** or **developmental spaces** and

are necessary to accommodate the permanent teeth which have a larger mesio-distal dimension than the primary teeth.

- **Simian space or primate space or anthropoid space:** The physiological spaces occurring mesial to maxillary canine or distal to mandibular canine are referred to as primate spaces.
- The absence or presence of these spaces serves as an indicator of future sufficiency of space in the dental arches for the permanent teeth.
- **Primary molar relationships:** (Fig. 7.4)
  - *Described in three ways:* Flush terminal plane, mesial step and distal step based on the relationship of the distal surface of second primary molar.
  - *Flush terminal plane:* Distal surface of primary mandibular second molar and maxillary second molar are in the same plane. This is also referred to as end to end molar relationship.
  - *Mesial step:* The distal surface of primary mandibular second molar is mesially located to the distal surface of the primary maxillary second molar.
  - *Distal step:* Distal surface of the primary mandibular second molar is distally located to the distal surface of the primary maxillary second molar.
- **Effects of terminal plane relationship:** The effects of these relationships have a bearing on the relationship of permanent molars.
  - It is considered that a flush terminal plane in deciduous dentition may lead to either an end on molar relation, a class I or a class II molar relation in permanent dentition.
  - Distal step in primary dentition may lead to class II permanent molar relation.
  - Mesial step in primary dentition may lead to either a class I relation or class III molar relation.

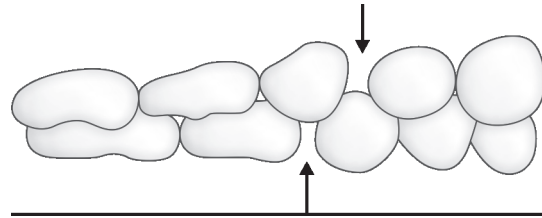


Fig. 7.3: Primate space

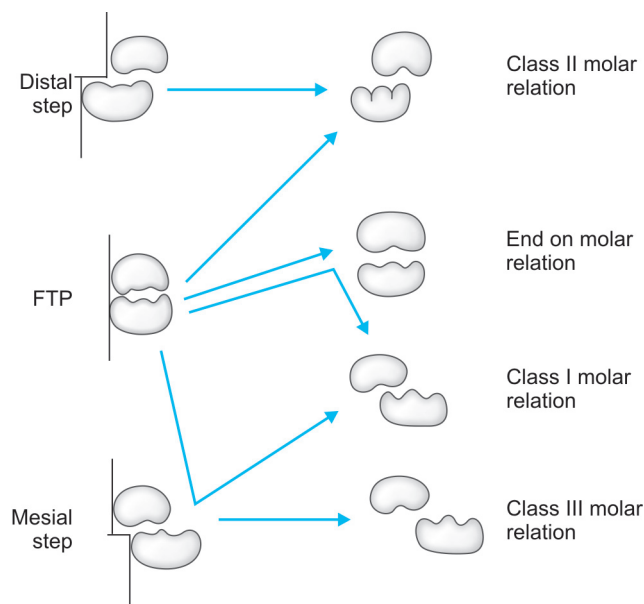


Fig. 7.4: Primary molar relationship



- Other factors which have an influence on molar relationships include differential growth of the jaws, forward growth of the mandible and sufficient Leeway space to accommodate a mesial drift of the permanent molars.
- The deciduous dentition period ends with the eruption of the permanent first molars and the mixed dentition or transition period starts from then.

### Mixed (Transitional) Dentition

- This period which indicates the transition from primary to permanent dentition begins about **6 years of age with the emergence of permanent molars**.
- As the permanent teeth in general have a greater mesiodistal dimension than the primary teeth, they are accommodated by the space provided by the growth of the jaws. In addition, the erupting permanent teeth utilize the physiological spaces available in the deciduous dentition.
- **Leeway space of Nance:** (Fig. 7.5)
  - This space is defined as the difference in the combined mesiodistal width of C, D, and E (deciduous canine, first molar, and second molar) and mesiodistal width of 3, 4, and 5 (permanent canine, first premolar, and second premolar).
  - The space is 1.8 mm in maxilla (0.9 mm in each quadrant) and 3.4 mm in mandible (1.7 mm in each quadrant).
  - *Significance:* This space allows the mesial movement of mandibular molar thereby guiding them into proper occlusion.
- Permanent molars are initially in an end-on relationship. Later this is converted into a class I molar relationship by the following factors:
  - Mesial drifting of mandibular molar utilising the physiological space and Leeway space of Nance.
  - Differential forward growth of the mandible.
- **Incisal liability:** Because of the discrepancy in mesiodistal crown dimensions between the primary and permanent incisors, some degree of transient crowding may occur at around 8 to 9 years of age until the emergence of canine when the space for the teeth may again be adequate. This is referred to as incisal liability.
- **Ugly duckling stage:** Around 8–10 years of age, while the permanent maxillary canines are erupting; they exert pressure on the roots of the maxillary lateral incisors. This causes flaring of the crowns of permanent maxillary central and lateral incisors in distal direction resulting in spacing between the teeth. This is known as ugly duckling stage and disappears as soon as the canines erupt. They do not possess much clinical significance except for the appearance (Fig. 7.6).
- The permanent molar relationship is categorized as follows:
  - *Class I:* When the mesiobuccal cusp of the maxillary first molar aligns with the buccal groove of the mandibular first molar.
  - *Class II:* When the buccal groove of the mandibular first molar is distally positioned when in occlusion with the mesiobuccal cusp of the maxillary molar.

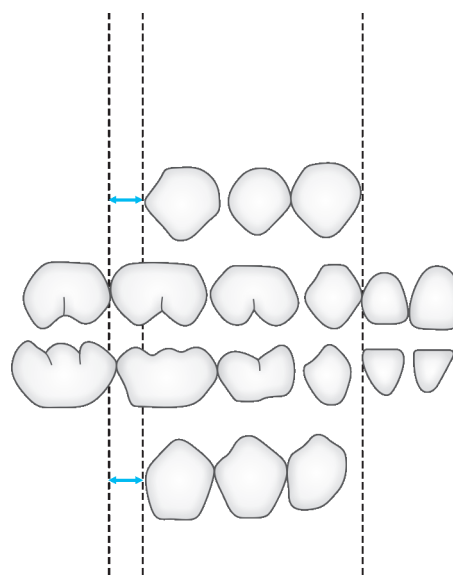
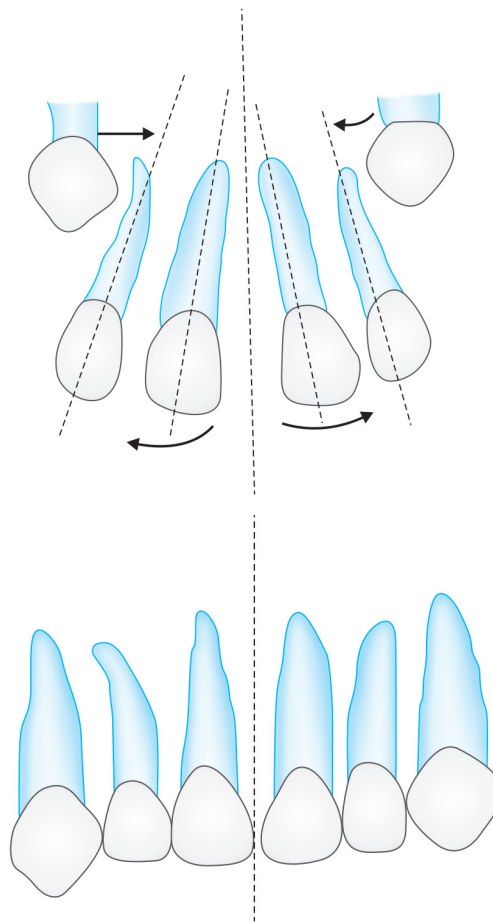


Fig. 7.5: Leeway space of Nance



**Fig. 7.6:** Ugly duckling stage

- *Class III*: When the buccal groove of mandibular first molar is mesially placed in relation to the mesiobuccal cusp of the maxillary first molar when the teeth are in occlusion.

### Permanent Dentition

#### *Sequence of eruption:*

- Maxilla: 6-1-2-4-3-5-7-8 or 6-1-2-4-5-3-7-8
- Mandible: 6-1-2-3-4-5-7-8

## 2. DENTAL ARCH FORM

- a. The teeth are positioned on the maxilla and mandible in such a way to produce a curved arch when viewed from the occlusal aspect. This arch form is largely determined by the shape of the underlying basal bone.
- b. In general, the alignment of the teeth in both the arches follows a parabolic curve. Variations of the arch form are U-shaped (square form), ellipsoid, rotund or tapered. The tapered arch form (V-shaped) generally occurs in the maxillary arch where there is narrowing of the anterior maxilla secondary to thumb sucking habit.

- c. The tooth alignment in the arches is divided into three segments—anterior, middle, and posterior. The anterior segment is described by a curved line and includes anterior teeth up to the labial ridge of canine. The middle segment is described by a straight line which includes distal portion of canine, premolars, and mesiobuccal cusp of first molar. The posterior segment is again a straight line from distobuccal cusp of first molar and includes the buccal surface of second and third molar.
- d. Under resting conditions, the teeth, and the dental arches are in space referred to as **Neutral space** which is balanced by two set of forces. The lips and cheeks generate muscular forces externally which are balanced by the internal muscular forces arising from the tongue thereby maintaining the dental arches and the teeth in normal alignment. Any imbalance of these forces may result in malocclusion or abnormal alignment of arches. **Examples** of such forces are tongue thrusting which generates greater outward forces from the tongue against the teeth leading to its protrusion. In mouth breathing, pressure of the lips on the teeth is more than the outward pressure of the tongue.

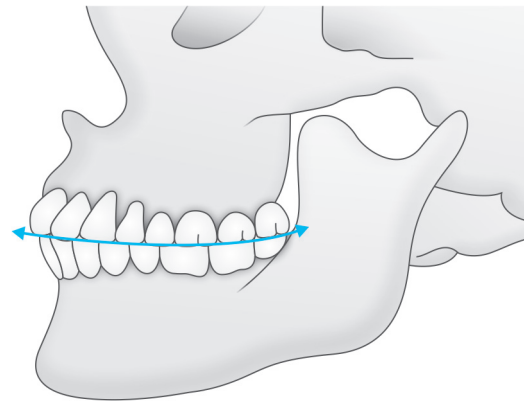
### 3. CURVATURES OF OCCLUSAL PLANES

- a. The occlusal surfaces of the dental arches do not generally conform to a flat plane. The mandibular arch conforms generally to one or more curved planes which appear concave while the curvature at the opposing maxillary arch appears convex.
- b. Some of the curves are:

- i. Curve of Spee (anteroposterior curve of occlusal plane).
- ii. Curve of Wilson (side to side curve)
- iii. Curve of Monson

- **Curve of Spee:** (Fig. 7.7)

- This is an anteroposterior curve of the occlusal surfaces and is viewed from buccal surface.
- The curve of Spee begins at the tip of the lower cuspid and touches the buccal cusp tips of all the mandibular posterior teeth and continues to the anterior border of the ramus. An ideal curve of Spee is aligned so that a continuation of this arc would extend through the condyles. The curvature of this arc would relate, on average, to part of a circle with a 4-inch radius.



**Fig. 7.7:** Curve of Spee

- *Function:* Allows for the normal functional protrusive movements of the mandible.

- **Curve of Wilson:** (Fig. 7.8)

- This is a mediolateral curve and is viewed from the anterior aspect with the mouth slightly open.
- The curve of Wilson contacts the buccal and lingual cusp tips of each side of the arch. It results from the inward inclination of the lower posterior teeth, making the lingual cusps lower than the buccal cusps on the mandibular arch; the buccal cusps are higher than the lingual cusps on the maxillary arch because of the outward inclination of the upper posterior teeth.

- **Functions:** Allows for those requisite movements that are used in chewing functions. The lingual inclination of the lower posterior teeth positions the lingual cusps lower than the buccal cusps. This design permits easy access to the occlusal table. As the tongue lays the food on the occlusal surfaces, it is stopped from going past the chewing position by the taller buccal cusps.
- **Curve of Monson:** Is an extension of curve of Spee wherein a spherical curvature is visualized involving both the right and left bicuspid and molar cusps and the right and left condyles. It was supposed that the centre of a sphere with an eight inch diameter was the vector for converging lines of masticatory forces passing through the center of the teeth and that the occlusal surfaces of the molar teeth were congruent with the surface of the sphere of some dimension.
- **Bennett movement:** The movement of the mandible to the right or left during mastication is referred to as Bennett movement.

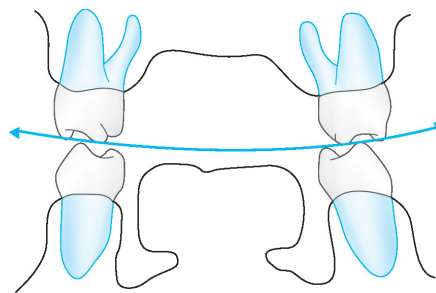


Fig. 7.8: Curve of Wilson

#### **Relationship of teeth:**

**Centric relation:** It is the most posterior position of the mandible relative to the maxilla at a given vertical dimension.

**Centric occlusion:** Refers to the relationship of the mandible to the maxilla when the teeth are in maximum occlusal contact, irrespective of the position or alignment of the condyle-disk assemblies.

## **4. INCLINATION AND ANGULATION OF THE ROOTS OF THE TEETH**

The inclination of axes of the maxillary and mandibular teeth to each other varies with each tooth group. The importance of the relative root angles helps relate the direction of occlusal forces in restorations along the long axis of teeth, guides the control of orthodontic forces for proper tooth angulation, aids in using templates for implant placement and also in visualization how the X-ray beam must be directed. The angle at which the tooth is placed depends on its function and lines of forces brought about during function. The mesiodistal and faciolingual inclinations are described in terms of angle between the long axis of a tooth and a line drawn perpendicular to a horizontal or median plane. The maximum faciolingual inclination of teeth is seen with maxillary central incisors which has an inclination of  $28^\circ$  while the least is with maxillary premolars at  $4-5^\circ$ . The mesiodistal angulation of the mandibular molars is highest between  $10-14^\circ$  while mandibular lateral incisors do not show any angulation.

## **5. FUNCTIONAL FORM OF THE TEETH AT INCISAL AND OCCLUSAL THIRDS**

The incisal or occlusal thirds of the tooth crowns present convex or concave tooth surface at all contacting tooth areas. When the teeth of one jaw comes in contact with the occlusal surface of the antagonist teeth, these curved surfaces come in contact with each other. The lingual surface of maxillary incisors present some concave surfaces which come in contact with the convex portions present in the incisal ridges of mandibular incisors. In the posterior teeth, the depressions in the depth of sulci and developmental grooves contact with the curved portion of the cusp and marginal ridges.

### Escapement Spaces/Spillway Spaces (Fig. 7.9)

Although the teeth in centric occlusion seem to intercusate closely, escapement spaces have been provided between the teeth which are needed for efficient occlusion during mastication. Escapement space is provided in the teeth by the form of cusp and ridges, the sulci and development grooves and the interdental spaces or embrasures when the teeth come together in occlusion. The escapement spaces are reduced with increase in occlusal contact and vice-versa.

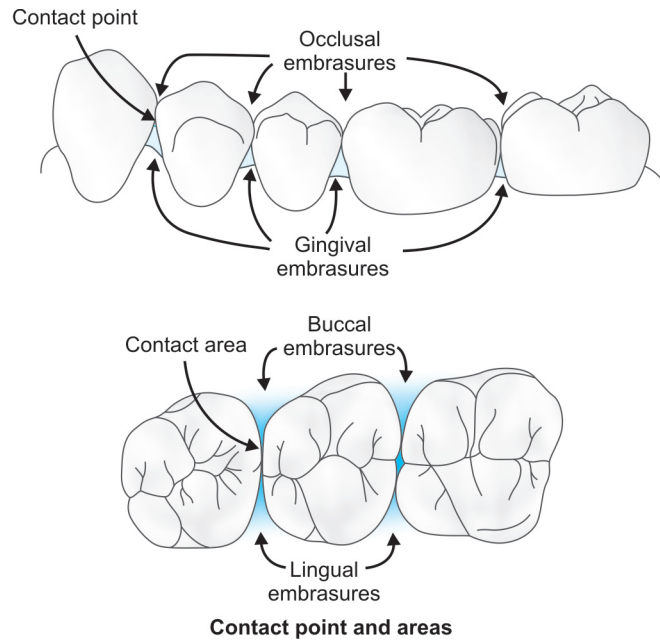


Fig. 7.9: Escapement spaces/spillway spaces

### 6. FACIAL AND LINGUAL RELATIONS OF EACH TOOTH IN ONE ARCH TO ITS ANTAGONISTS IN THE OPPOSING ARCH IN CENTRIC OCCLUSION (OVERLAP OF THE TEETH)

- a. The arch form of the maxilla tends to be larger than that of the mandible. This results in the maxillary teeth overhanging the mandibular teeth when the teeth are in centric occlusion.
- b. Under normal circumstances of maximal intercuspation the maxillary anterior teeth overlap the mandibular teeth. The overlap could be horizontal (overjet) or vertical (overbite).
- c. **Overbite** (Fig. 7.10): Overbite is defined as the vertical overlap of the maxillary and mandibular anterior teeth, where the maxillary anterior teeth extend below the incisal edges of the mandibular anterior teeth.
- d. **Overjet** (Fig. 7.11): Overjet is defined as the horizontal overlap of the maxillary and mandibular anterior teeth, where the maxillary anterior teeth are labial to incisal edges of the mandibular anterior teeth.



Fig. 7.10: Overbite



Fig. 7.11: Overjet

- e. Ideally overjet and overbite is in the range of 2–4 mm.
- f. **Clinical significance:**
  - i. Overlapping of the maxillary teeth over the mandibular teeth protects the cheeks, lips and tongue during the opening and closing movements of the jaws. Insufficient horizontal overlap of the molars may result in cheek biting.
  - ii. There should be sufficient vertical overlap to enable the disocclusion of the posterior teeth in function.
- g. Excessive vertical overlap of the anterior teeth may result in tissue impingement and is referred to as **impinging overbite**.
- h. **Incisal guidance:** Is a measure of the amount of movement and angle at which the lower incisors and mandible must move from the overlapping position (centric occlusion) to an edge to edge relationship with maxillary incisor.

## 7. OCCLUSAL CONTACT RELATIONS AND INTERCUSPAL RELATIONS BETWEEN THE ARCHES

- **Supporting cusps:** The lingual cusps of the maxillary posterior teeth and the buccal cusps of the mandibular posterior teeth that make contact with the opposing teeth are referred to as supporting cusps.
- **Centric stops:** The areas of occlusal contact that a supporting cusp makes contact with opposing teeth in centric occlusion are centric stops. These contribute to occlusal stability.
- **Guiding cusps:** The upper buccal cusps and the lower lingual cusps make contact on their occlusal sides only when the mandible makes gliding movements. Since these cusps provide guidance for the mandibular movement, they are known as guiding cusps.

## 8. OCCLUSAL CONTACT RELATIONS AND INTERCUSPAL RELATIONS OF THE TEETH

- **Eccentric movements:** Occlusal contact relations away from the intercuspal position involve all possible movements of the mandible within the envelope of border movements. These movements are referred to as lateral, protrusive and retrusive movements. Lateral movements may be either to the right or left.
- **Lateral movements:** When the mandibular teeth make their initial contact with the maxillary teeth in right or left lateral occlusion, they bear a right or left lateral position to centric occlusion. During the right lateral movement, the mandible is depressed and the dental arches are separated, the jaw moves to the right and brings the teeth together at points right of the intercuspal position in right working position. On the left side, the teeth may or may not make contact. In respect to lateral movements, the side towards which the mandible moves is the working side and the opposite side is the non-working side (known as balancing side in complete dentures).
  - **Working side/working occlusion:** During lateral movements, when the teeth are brought together with the mandible to one side, the condyle of the same side (working side) remains in the posterior position and the condyle of the opposing side (non-working side) have been moved forward in the glenoid fossa. This type of closure is referred to as working position and the sliding action of the mandible from working position back to centric occlusion is working occlusion.
  - **Balancing side/Balanced occlusion:** The opposite side of working side in lateral movements is referred to as non-working side or balancing side. The teeth on this side may or may not make contact. The function of this side during all types of mandibular movement is



to balance the mandible against the maxilla. When all the teeth in both the arches occlude perfectly in all positions and excursions of the mandible, they are said to be in balanced occlusion. Balanced occlusion is seen only in complete dentures and is rarely seen in natural dentition.

- **Protrusive occlusion:** When the teeth are closed with the protruded mandible so that both the condyles are equally forward in the glenoid fossa and the incisors are edge to edge, while at the same time the mandibular posterior teeth contact the maxillary posterior teeth, the closure is called protrusive position. As the mandible is retracted from the protrusive position to centric occlusion, the relationship of upper and lower teeth changes in such a manner that the incisal edges of the mandibular anterior teeth slide along the sulci and cross the marginal ridge of the opposing teeth at the same time. This sliding action is called as **protrusive occlusion** and is used mostly in the act of cutting of food when it is too large to be taken wholly into the mouth.
- **Retrusive movements:** A retrusive movement normally follows a protrusive movement back to the intercuspal position (centric occlusion). Retrusive movement from centric occlusion to the retruded contact position where the condyles are in the rearmost, uppermost position seems to occur in bruxism but infrequently in mastication and swallowing.

## 9. NEUROBEHAVIORAL ASPECTS OF OCCLUSION

The neurobehavioral aspect of occlusion relates to the function and parafunction action of stomatognathic system. Functions include a variety of actions such as chewing, sucking, swallowing, speech and respiration while parafunctional habits refer to habits like bruxism. The stability of the occlusion and the maintainance of tooth position are dependent on all the forces that act on the teeth. Occlusal forces, eruptive forces, lip, and cheek pressure, periodontal support and tongue pressure are all involved in maintaining the position of teeth. This requires a very intricate control system involving a number of guiding influences from teeth and their supporting structures along with the involvement of higher centers in the central nervous system.

### SAQs (3 Marks)

#### Q 1. What are curvatures of occlusal planes?

(Dec. 2005, June 2006, May 2007, 2011, Nov. 2010, 2011)

**Ans.** The occlusal surfaces of the dental arches do not generally conform to a flat plane. The mandibular arch conforms generally to one or more curved planes which appear concave while the curvature of the opposing maxillary arch appears convex.

Some of the curves are:

1. Curve of Spee
2. Curve of Wilson
3. Curve of Monson
4. Bonwill's equilateral triangle.

#### 1. CURVE OF SPEE (May 2011)

- Concept of this curve was introduced by F. Graf Von Spee in 1890.
- This is an anteroposterior curve of the occlusal surface and is viewed from buccal surface.

- This curvature is within sagittal plane only.
- The curve of Spee begins at the tip of the lower cuspid and touches the buccal cusps of all the mandibular teeth and continues to the anterior border of the ramus.
- An ideal curve of Spee is aligned so that a continuation of this arc would extend through the condyles.

The curvature of this arc would relate, on an average, to part of a circle with 4-inch radius.

### Significance

- It has clinical significance in relation to tooth guidance—that is canine and/or incisal guidance as applied in orthodontics and restorative dentistry.
- Curve of Spee allows for the normal functional protrusive movements of the mandible.

## 2. CURVE OF WILSON

- This is a mediolateral curve viewed from anterior aspect with the mouth slightly open.
- The cusp tips of posterior teeth follow a gradual curve from left side to right side. This is curve of Wilson.
- The curve of maxillary arch is convex and the curve of mandibular arch is concave.
- Thus, the lingual cusps of the posterior teeth are aligned at a lower level than the buccal cusps on both sides and in both the arches.

### Significance

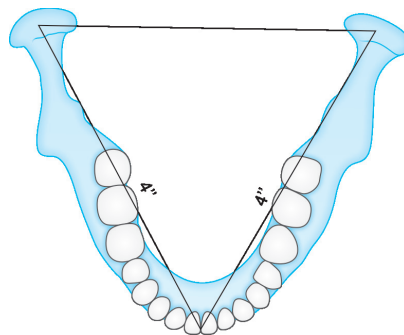
It allows for those requisite movements that are used in chewing functions.

## 3. CURVE OF MONSON

- It is a three-dimensional combination of curves of Spee and Wilson.
- The concept was introduced by G. S. Monson in 1920.
- According to Monson, all cusps and incisal edges in a natural dentition are tangent to a surface of a sphere, approximately 4-inches in radius with center in the area of glabella.

## 4. BONWILL'S EQUILATERAL TRIANGLE (May 2007) (Fig. 7.12)

Taking the point between two mandibular central incisors and mid-point of condyles, an equilateral triangle is formed with the sides approximately 4-inches in measurement known as **Bonwill's equilateral triangle**.



**Fig. 7.12:** Bonwill's triangle



**Q 2. Describe compensating curvatures.***(June 2005, Nov. 2015)***Ans. Compensating curvatures**

- All surfaces of dental arch conform to the curvatures.
- When viewed from occlusal aspect each dental arch is U-shaped.
- The buccal cusp tips follow a curved line around the outer edge of the dental arch.
- The lingual cusp tips follow a curved line nearly parallel to the buccal cusp tip curved line.
- Between the buccal and lingual cusps is the sulcular groove which runs anteroposteriorly throughout the length of the posterior teeth. The curvature of the mandibular arch is concave and the maxillary arch is convex. As mandibular teeth appear in advance of maxillary teeth, the mandibular teeth are the ones which establish compensating curvatures. The maxillary teeth have to adapt themselves to the mandibular teeth. The curve of one arch is compensated by another arch hence they are called 'compensating curvatures'.

**Importance of compensating curvatures:** Compensatory curves are developed to compensate for the paths of the condyle as the mandible moves from centric to eccentric position.

Although the maxillary and mandibular curvatures are opposite, they are complimentary and thereby may help achieve occlusal balance during mastication by encouraging simultaneous contact in more than one area of the dental arches.

**Q 3. Define overjet.***(May 2002, 2012, Nov. 2010)***Overjet and overbite****Ans. Overjet**

- The arch form of the maxilla tends to be larger than that of the mandible. As a result the maxillary teeth overhang the mandibular teeth when the teeth are in centric occlusion (the position of maximal intercuspation).  
The lateral or anteroposterior aspect of this overhang is called 'overjet'.
- Overjet is defined as the horizontal overlap of the maxillary and mandibular anterior teeth where the maxillary anterior teeth are labial to incisal edges of the mandibular anterior teeth.
- Ideally overjet is in the range of 2–4 mm.

**Significance**

- Overjet protects the cheeks, lips and tongue during the opening and closing movements of the jaws.
- Insufficient horizontal overlap of the molars may result in cheek biting.

**Overbite**

It is defined as the vertical overlap of the maxillary and mandibular anterior teeth, where the maxillary anterior teeth extend below the incisal edges of the mandibular anterior teeth.

Ideally, the overbite is in the range of 2–4 mm.

**Significance**

- There should be sufficient overlap to enable the disocclusion of the posterior teeth in function.
- Excessive vertical overlap of the anterior teeth may result in tissue impingement and is referred to as "impinging overbite."

**Q 4. Define freeway space.**

(Oct. 2003)

**Ans.**

- Freeway space is the normal 2–6 mm space between occluding surfaces of the maxillary and mandibular teeth when mandible is in physiologic resting position or
- The amount of separation between the occlusal surfaces of maxillary and mandibular teeth when mandible is in its rest position.
- **Synonyms:** Interocclusal clearance, interocclusal distance, interocclusal gap interocclusal rest space.

**Q 5. Describe Bennett shift (movement).**

(Oct. 2003)

**Ans.**

- The movement of the mandible to the right or left during mastication is referred to as 'Bennett movement'. It is the lateral movement of mandible produced when the mandibular condyles slide along mandibular fossae during sideways jaw movement.
- It is the bodily side shift of the mandible toward the side in function and occurs to some extent in most patients during lateral functional movements.
- It may significantly influence the movement of the mandibular cusp tips, thereby determining the proper inclination, direction and contour of the facial and lingual grooves in posterior teeth.

**Q 6. What is ugly duckling stage?**

(July 2005)

**Ans.**

- The ugly duckling stage was first described by B H Broadbent in 1937.
  - It is a mixed dentition stage also called as 'Broadbent phenomenon'.
  - It is a transient or self-correcting malocclusion seen in the maxillary incisor region between the age of 8–10 years during the eruption of permanent maxillary canines.
  - It is a stage of dental development preceding the eruption of permanent canines which exert pressure on the roots of maxillary lateral incisors causing flaring of crowns of maxillary central and lateral incisors in distal direction resulting in spacing between the teeth.
- It is called ugly duckling stage because dentition in children at this stage looks ugly due to spacing between the teeth. It disappears as soon as canines erupt (around 11–12 years).

**Q 7. What is dental arch form?**

(Nov. 2010)

**Ans. Dental Arch Form**

- The teeth are positioned on the maxilla and mandible in such a way as to produce a curved arch when viewed from the occlusal aspect. This arch form is largely determined by the shape of the underlying basal bone.
- In general, the alignment of the teeth in both the arches follows a parabolic curve. Variations of the arch form are U-shaped (square form), ellipsoid, round or tapered. The tapered arch form (V-shaped) generally occurs in the maxillary arch where there is narrowing of the anterior maxilla secondary to thumb-sucking habit.
- The tooth alignment in the arches is divided into three segments, anterior, middle, and posterior. The anterior segment is described by a curved line and includes anterior teeth up to the labial ridge of canine. The middle segment is described by a straight line which includes distal portion of canine, premolars and mesiobuccal cusp of first molar. The posterior segment is again a straight line from distobuccal cusp of first molar and includes

the buccal surface of second and third molars. The concept of arch segment allows the arches to overlap slightly so that canines and first molars are cooperating in more than one segment indicating that canines and molars function as anchor supports for both arches.

- Under resting conditions, the teeth and the dental arches are in space referred to as **Neutral space** which is balanced by two set of forces. The lips and cheeks generate muscular forces externally which are balanced by the internal muscular forces arising from the tongue thereby maintaining the dental arches and the teeth in normal alignment. Any imbalance of these forces may result in malocclusion or abnormal alignment of arches. Examples of such forces are tongue thrusting which generates greater outward forces from the tongue against the teeth leading to its protrusion.
- In mouth breathing, pressure of the lips on the teeth is more than the outward pressure of the tongue.

### Overlap of the Teeth

- The maxillary arch form of the maxilla tends to be larger than that of the mandible. This results in the maxillary teeth overhanging the mandibular teeth when the teeth are in centric occlusion.
- The mandibular arch is narrower in width than the maxillary arch. This relation is caused by the difference in MD width between mandibular and maxillary anterior teeth and by the lingual projection of the crowns of the mandibular posterior teeth. This relationship is reflected by the overjet and overbite characteristics of teeth.
- Mandibular arch is smaller compared to maxillary arch hence all the teeth of this arch are forwarded to midline.
- Under normal circumstances of maximal intercuspation the maxillary anterior teeth overlaps the mandibular teeth. The overlap could be horizontal (overjet) or vertical (overbite).
- **Overbite:** It is defined as the vertical overlap of the maxillary and mandibular anterior teeth where the maxillary anterior teeth extend below the incisal edges of the mandibular anterior teeth.
- **Overjet:** It is defined as the horizontal overlap of the maxillary and mandibular anterior teeth where the maxillary anterior teeth are labial to incisal edges of the mandibular anterior teeth.
- Ideally overjet and overbite is in the range of 2–4 mm.

### Clinical Significance

- Overlapping of the maxillary teeth over the mandibular teeth protects the cheeks, lips, and tongue during the opening and closing movements of the jaws. Insufficient horizontal overlap of the molars may result in cheek biting.
- There should be sufficient vertical overlap enable the disocclusion of the posterior teeth in function.
- Excessive vertical overlap of the anterior teeth may result in tissue impingement and is referred to as **impinging overbite**.

### Q 8. What is Leeway space of Nance?

#### Ans. Leeway Space of Nance

- Leeway Space of Nance is defined as the difference between combined mesiodistal width of primary canine and molars, i.e. deciduous canine, first molar, second molar, and mesiodistal width of permanent canine and both premolars.

- Usually, the sum of mesiodistal width of C, D, E, is larger than the sum of mesiodistal width of 3, 4, 5.  
This difference, i.e. the Leeway Space in maxilla is 1.8 mm (0.9 mm in each quadrant) and in mandible it is 3.4 mm (1.7 mm in each quadrant).

### Significance

It is partly used for alignment of permanent incisors and partly for normal permanent molar relationship.

### Q 9. Define occlusion in deciduous dentition.

(May 2013)

Ans.

- Deciduous dentition stage starts with eruption of mandibular central incisors at around 6 months of age and ends with the eruption of first permanent molar at around 6 years of age.
- The eruption of all primary teeth is completed by the age of 2½–3 years of age. With the eruption of second primary molar.
- Each tooth in the arch occludes with two teeth in the opposing jaw except for mandibular central incisor and the maxillary second molar.
- Features of normal primary dentition:**
  - Spaced anteriors
  - Primate spaces
  - Deep overbite and increased overjet
  - Straight terminal plane
  - Sallow cuspal interdigitation
  - Almost vertical inclination of anterior teeth
  - Ovoid arch form
  - Flat occlusal plane or almost no curve of Spee.
- Sequence of eruption:**



- Characteristics of occlusion in deciduous dentition:**
  - Interdental spacing
  - Incisor relationship
  - Molar relationship

**1. Interdental spacing:** Generalized spacing is very common in deciduous dentition. These spaces are called **physiological or developmental spaces**.

These spaces are necessary to accommodate the permanent teeth which have a larger mesiodistal dimension than the primary teeth.

This space is about 4 mm in the maxillary arch and 3 mm in mandibular arch.

**Primate/Simian/Anthropoid/Baume space.**

The physiological space seen mesial to maxillary canine and distal to mandibular canine is called 'primate space'. These spaces are similar to the dentition of the primates.

These spaces are utilized during early mesial shift of molars from end-on to Class I relation.

**2. Incisor relationship:** There is increased overbite and overjet in the initial phase of deciduous dentition.

Gradually, it gets corrected due to attrition of anteriors, eruption of posterior teeth and due to growth of mandible.

**3. Primary molar relationship:** In deciduous dentition the mesiodistal relation between the upper and lower second molar is called 'terminal plane'.

- In flush terminal plane distal surface of deciduous lower second molar and upper second molar are in the same vertical plane. It is also referred to as end-on molar relationship 37%.
- In mesial step, the distal surface of deciduous lower second molar is mesial to the distal surface of deciduous upper second molar 49%.
- In distal step, the distal surface of deciduous lower second molar is distal to the distal surface of upper second molar.

**Q 10. What are escapement spaces/spillway spaces?**

**Ans.**

- Although the teeth in centric occlusion seem to intercusate closely, escapement spaces have been provided between the teeth which are needed for efficient occlusion during mastication.
- Escapement space is provided in the teeth by the form of cusp and ridges, the sulci and developmental groove and the interdental spaces or embrasures. When the teeth come together in occlusion.
- The escapement spaces are reduced with increased in occlusal contact or vice-versa.
- When two adjacent teeth in the same arch are in contact with each other there are four triangular continuous spaces adjacent to the contact areas. These are embrasures.
- They are named according to their location which depends on the aspect from which the teeth are viewed.
- From facial and lingual aspect—incisal and cervical embrasures are seen.
- From occlusal aspect—facial and lingual embrasures are seen.
- It is significance that it provides a Spillway for food during mastication and makes teeth self-cleansing, prevents food from impinging on gingiva.

**Q 11. Explain theories of occlusion.**

(Oct. 2002)

**Ans.**

- 1. Theory of equilateral triangle:** This theory was proposed by Bonwill which states that an equilateral triangle is formed with the three corners of the triangle being right condyle, left condyle, and a point between the two mandibular central incisors. The distance between the two points (or one side of the triangle) is 4 inches or 10 cm. The theory postulates that the teeth move in relation to each other as guided by the condyle control and the incisal point.
- 2. Conical theory of occlusion:** This theory postulates that lower teeth move over the surface of the upper teeth as over the surface of a cone with a generating angle of 45°. The central axis of the cone is tipped at an angle of 45° to the occlusal plane. In case of posterior teeth, the cusps of teeth have 45° and each cusp behaves like a separate cone. The cusps of the lower posterior teeth incline over the cusps of the maxillary teeth similar to that of the anterior teeth.

3. ***Spherical theory of occlusion:*** This theory was proposed by G.S. Monson in 1918. According to the theory, the lower teeth move over the surface of the upper teeth as over the surface of a sphere. This sphere has a diameter of 8 inches or 20 cm with its center near the glabella. The surface of the sphere passes through the glenoid fossa along the articular eminence. This theory postulated that teeth are positioned in such a way that the anteroposterior and mesiodistal inclinations of the teeth are in harmony with the spherical surface.
4. ***Theory of organic occlusion:*** The theory was proposed by Stuart and Stallard in 1947. They proposed that teeth are in harmony with muscles and joints in function; the latter determining the mandibular position of occlusion throughout tooth guidance. Organic occlusion has the following features: teeth are passive to the paths of mandibular movements, cusp fossa contact relationship are developed when jaws are in centric relation, posterior teeth protect anteriors during centric occlusion, separation of posterior teeth on both sides of the arch when jaw moves away from the centric occlusion, vertical overlap of maxillary central incisors is sufficient to provide separation of posterior teeth when the incisor are at an end to end relation and during lateral movement of the mandible, the canines cause disclusion of all the other teeth.

## MULTIPLE CHOICE QUESTIONS (MCQs)

1. All teeth have two antagonists in the opposing jaw except
  - a. Mandibular central incisor
  - b. Maxillary third molar
  - c. Both a and b
  - d. Mandibular third molar
2. In centric occlusion, the massive and pointed mesiolingual cusp portion of maxillary first molar fits into
  - a. Distal fossa of lower first molars
  - b. Mesial fossa of lower first molars
  - c. Major/central fossa of lower first molars
  - d. Mesial fossa of upper first molar
3. The distolingual cusp of maxillary first molars are in apposition
  - a. To the distal triangular fossa and marginal ridge of mandibular first molars
  - b. To the mesial marginal ridge of the molar distal to the mandibular first molar
  - c. Both a and b
  - d. None of the above
4. In centric occlusion, lingual cusp of mandibular first premolar
  - a. Contacts with distal marginal ridge of maxillary canine
  - b. Contacts with cingulum of maxillary canine
  - c. Does not contact with any teeth
  - d. Contacts with mesial marginal ridge of maxillary canine
5. In physiologic rest position of mandible
  - a. There is slight contact
  - b. There is maximum contact
  - c. There is no contact
  - d. The contact depends on the size of the cusp
6. Usually the canine erupts before premolar in
  - a. Maxillary arch
  - b. Mandibular arch
  - c. Both a and b
  - d. None of the above
7. Dentition in girls erupts earlier than in boys by about
  - a. 5 months
  - b. 3 months
  - c. 2 months
  - d. 1 months
8. In Angle's class I molar relationship mesiolingual cusp of maxillary first molar occludes into the
  - a. Mesial triangular fossa
  - b. Distal triangular fossa
  - c. Central fossa
  - d. None of the above
9. In normal occlusion, the buccal cusps of maxillary teeth occlude
  - a. With the lingual surface of mandibular teeth
  - b. With the buccal surface of mandibular teeth
  - c. In the central sulci of mandibular teeth
  - d. Distal surface of permanent mandibular first molar
10. In normal occlusion mesiobuccal cusp of permanent maxillary first molar occludes with
  - a. Mesiobuccal groove of permanent mandibular first molar
  - b. Distobuccal groove of permanent mandibular first molar
  - c. Mesial surface of permanent mandibular first molar
  - d. Distal surface of permanent mandibular first molar.

1-c, 2-c, 3-c, 4-c, 5-c, 6-b, 7-a, 8-c, 9-b, 10-a

11. If a permanent first molar is lost, the permanent second molar drifts to the
- Distal side
  - Mesial side
  - Buccal side
  - Lingual side
12. 'Leeway space' is
- Physiologic spacing between deciduous teeth
  - The difference in labiolingual width between deciduous molars and premolars
  - The difference in mesiodistal width of deciduous molars and permanent molars
  - The difference in combined mesiodistal width of deciduous canine and molars and of permanent canines and premolars
13. The interocclusal freeway space in normal circumstances should be
- 0–1 mm
  - 1–2 mm
  - 2–4 mm
  - 3–5 mm
14. In Primary dentition the physiologic space mesial to maxillary canine and distal to mandibular canine is called
- Primate/Simian space
  - Leeway space
  - Freeway space
  - Diastema
15. Curve which runs in anteroposterior direction is
- Curve of Spee
  - Curve of Wilson
  - Monson's curve
  - None of the above
16. Freeway space is maximum at
- Incisor region
  - Canine region
  - Premolar region
  - Molar region
17. In the unworn dental arch all the following occlusal contacts are there *except*
- Point to point
  - Point to area
  - Edge to edge
  - Edge to area
  - Area to area
18. The cusp of the maxillary molar that serves as a reference point in identifying Angle's Class I, Class II, Class III occlusion is
- Distobuccal cusp
  - Mesiobuccal
  - Mesiolingual
  - Distolingual
19. When the mandible is in its physiologic rest or postural position, contact of teeth is
- Maximum
  - Premature
  - Slight
  - Not present
20. When posterior teeth are in normal ideal relationship, the following cusps are considered supporting cusps
- Maxillary lingual
  - Maxillary facial
  - Mandibular lingual
  - Mandibular facial
  - Both a and d
21. The following cusps are referred to as 'stamp cusps'
- Maxillary lingual cusps
  - Maxillary buccal
  - Mandibular buccal
  - Mandibular lingual
  - Both a and c
22. In the intercuspal position distobuccal cusp of permanent mandibular first molar occludes into
- The interproximal marginal ridge area between maxillary second premolar and first molar
  - Central fossa of maxillary first molar
  - Central fossa of maxillary second molar
  - Interproximal marginal ridge area between maxillary first molar and second molar

11-b, 12-d, 13-c, 14-a, 15-a, 16-a, 17-e, 18-b, 19-d, 20-e, 21-e, 22-b



- 23. Cusptip articulating with a marginal ridge area is called as**  
a. Normal cusp  
b. Plunger cusp  
c. Non-working cusp  
d. Deflected cusps
- 24. Forces of occlusion are mainly sustained by**  
a. Tough enamel  
b. Resilience of dentin  
c. Supporting cancellous bone  
d. PDL
- 25. Maximum mesiodistal inclination with respect to mid-sagittal plane is found in**  
a. Maxillary canine  
b. Mandibular lateral incisor  
c. Mandibular canines  
d. Maxillary molar
- 26. From proximal view, the tooth which has least labiolingual inclination is**  
a. Maxillary canine  
b. Maxillary central incisor  
c. Maxillary lateral incisor  
d. Mandibular central incisor
- 27. The teeth which have only one antagonist in the opposite arch are**  
a. Mandibular third molar and maxillary lateral incisor  
b. Mandibular central incisors and maxillary third molars  
c. Maxillary and mandibular third molars  
d. Maxillary and mandibular central incisor
- 28. Opening of mandible is initiated by**  
a. Cortical center  
b. Bulbay center  
c. Pre-central gyrus  
d. Post-central gyrus
- 29. The position of the jaw that is exclusively determined by the behavior of the mandibular musculature is**  
a. Postural      b. Terminal  
c. Intercuspal      d. None of the above
- 30. During nonmasticatory swallowing teeth are usually**  
a. Protruded  
b. In a working arrangement  
c. In contact in intercuspal position  
d. None of the above
- 31. Spacing between anterior teeth in the primary dentition is most frequently caused by**  
a. Thumb sucking  
b. Tongue thrusting  
c. The growth of the dental arches  
d. The pressure from the succedaneous teeth
- 32. The lingual cusps of the mandibular first molar must be restored to accomodate**  
a. Centric relation  
b. Working movement  
c. Non-working movement  
d. Maximum intercuspation
- 33. The smallest vertical dimension measurement will be present in one of the following position**  
a. Edge-to-edge  
b. Retruded contact  
c. Maximum intercuspation  
d. Retruded contact
- 34. When the mandible slides in a protrusive contacting movement, the mandibular teeth that make contact with maxillary lateral incisors are**  
a. Central and lateral incisors  
b. Central incisors and canines  
c. Lateral incisors and canines  
d. All of the above

- 35. Moving the mandible from a maximum intercuspal position to a retruded contact position usually results in**
- Increased occlusal vertical dimension
  - Decreased vertical overlap
  - Increased horizontal overlap
  - All of the above
- 36. In an ideal permanent tooth relationship, the tip of a mandibular canine in lateral excursion passes**
- Distal to the tip of maxillary canine cusp
  - Mesial to the tip of maxillary canine cusp
  - Directly in line with the maxillary canine cusp tip
  - Through the embrasure between the maxillary canine and first premolar
- 37. The wear facets on the incisal edges of the mandibular lateral incisors are caused by occlusion with the**
- Maxillary central incisors only
  - Maxillary central and lateral incisors
  - Maxillary lateral incisors and canines
  - None of the above
- 38. The non-working pathway of the maxillary cusps on the mandibular posterior teeth is towards the**
- Distobuccal
  - Mesiobuccal
  - Distolingual
  - Mesiolingual
- 39. The Bennett movement is best described as the**
- Medial shift of the working condyle
  - Lateral movement of the non-working condyle
  - Bodily shift of the mandible in the direction of the working condyle
  - Bodily shift of the mandible in the direction of the non-working condyle
- 40. In canine guided occlusion contact between posterior teeth occurs in**
- Centric occlusion only
  - Eccentric movement only
  - Protrusive movement only
  - Retrusive movement only
- 41. In protrusion mandibular right central incisor occludes with maxillary**
- Right lateral incisor only
  - Right central incisor only
  - Right and left central incisors only
  - Right central and lateral incisor
- 42. In protrusion maxillary right central incisor contacts with mandibular**
- Right and left mandibular central incisors
  - Right central and lateral incisors
  - Right central incisors only
  - Left central incisor only
- 43. In centric occlusion the cusp tip of maxillary canine opposes**
- Distal marginal ridge of mandibular canine
  - Facial embrasure between lower canine and premolar
  - Mesial marginal ridge of lower lateral incisors
  - Interproximal space between lower lateral and canine
- 44. The teeth in occlusion have**
- Surface contact
  - Cusp to cusp contact
  - Cusp to fossa contact
  - Marginal contact
- 45. Wilson curve in mandibular arch is**
- Concave
  - Convex
  - Concavoconvex
  - Convexoconcave

- 46. In ideal occlusion with class I molar and canine relationship, mesial cusp ridge of mandibular canine opposes maxillary**
- Lateral incisor on distal side
  - Canine on mesial side
  - Lateral incisor on mesial side
  - Canine on distal side
- 47. In an ideal occlusion mesial marginal ridge of maxillary canine**
- Opposes mesiobuccal cuspal ridge of mandibular first premolar
  - Opposes distal marginal ridge of mandibular canine
  - Is in line with mesial marginal ridge of mandibular canine
  - Opposes mandibular lateral incisor
- 48. In centric occlusion, cusp of mandibular canine will oppose**
- Marginal ridge of upper canine and first premolar
  - Marginal ridge of upper canine and lateral incisors
  - Cingulum of maxillary canine
  - Distal ridge of maxillary first premolar
- 49. In physiologic rest position of mandible there is**
- Slight contact
  - No contacts
  - Maximum contacts
  - None of the above
- 50. The movements of mandible during chewing can be described as**
- Being vertical and tear-drop in shape
  - Being horizontal and rhomboidal in shape
  - Occurring only on working side
  - Occurring only on non-working side
- 51. Direct lateral shift of condyle occurs**
- On working side
  - On balancing side
  - Both on working side and non-working side
  - Laterla shift never occurs
- 52. During lateral movements the balancing side of condyle moves**
- Forward, downwards, mesially
  - Forward, downwards, laterally
  - Forward, upwards, mesially
  - Backwards, downwards and mesially
- 53. The effect of benett shift will be on mesio-distal positioning of**
- Lingual cusps of all teeth
  - Buccal cusps of all teeth
  - Both buccal and lingual cusps
  - No effect on cusps
- 54. Which is the active component in masticatory apparatus**
- TMJ
  - Muscles of mastication
  - Molar teeth
  - All of the above
- 55. Free way space is maximum at**
- Incisor region
  - Canine region
  - Premolar region
  - Molar region
- 56. Longest stage of deglutition is**
- Stage I
  - Stage II
  - Stage III
  - All stages are equal
- 57. The smallest permanent tooth in the mouth is**
- Maxillary central incisor
  - Mandibular canine
  - Mandibular central incisor
  - Maxillary lateral incisor

# Blood and Nerve Supply to Teeth and Tongue

## SAQs (3 Marks)

**Q 1. Describe blood and nerve supply to tongue.**

(May 2007)

**Ans. Blood and Nerve Supply to Tongue**

- The tongue and floor of the mouth are supplied by lingual artery.
- The lingual artery is a branch of external carotid artery.
- Its dorsal lingual branch supplies the base of the tongue.
- The deep lingual branch supplies the body and apex of the tongue.
- One of its terminal branches communicates with the deep lingual artery of the opposite side and is called the 'arcus raninus'.
- Venous drainage of tongue is quite peculiar and is from two different routes for two different parts of tongue. The dorsal surface and side of the tongue drains into lingual vein, ventral surface drains into deep lingual veins.
- Venous blood from lingual vein drains into facial vein and later into internal jugular veins.

### Nerve Supply

- The tongue is developed from the contribution of different arches which is reflected in the nerve supply.
- Mucous membrane of anterior two-thirds of the tongue is supplied by mandibular branch of trigeminal nerve.
- Posterior one-third of the tongue is supplied by glossopharyngeal nerve, the ninth cranial nerve which carries the taste sensation from the posterior part.
- The hypoglossal nerve, the 12th cranial nerve supplies the voluntary muscles.
- Lingual branch of the mandibular branch of trigeminal nerve supplies the anterior two-thirds of the tongue for general sensation of pain, temperature, touch, etc.
- Chorda tympani branch of the 7th cranial nerve supplies the anterior two-thirds for special sensation of taste.
- Posterior one-third is supplied by 9th cranial nerve, the glossopharyngeal nerve.

**Q 2. Write about blood and nerve supply to teeth.****Ans. Blood Supply**

- Mandibular teeth and supporting structures are supplied by inferior alveolar artery which is a branch of maxillary artery.
- Inferior alveolar artery passes through the mandibular foramen to enter into the mandibular canal and terminate as mental and incisive arteries.
- Maxillary teeth receive arterial supply from two different sources: Posterior superior alveolar artery supplies the molars and premolars while anterior superior alveolar artery supplies the anterior teeth.
- The veins drain into either facial vein or pterygoid plexus of veins.
- The lymph vessels from teeth run directly into the submandibular nodes on the same side. Lymph from lower incisors may drain into submental nodes. Sometimes molars may drain directly into jugulodigastric group of nodes.

**Nerve Supply**

The pulp and periodontal membrane have the same nerve supply which is different from that of the overlying gingiva.

- Mandibular incisors are innervated by incisive nerve premolar and molars are innervated by inferior alveolar nerve.
- Maxillary anterior teeth are innervated by anterior superior alveolar nerve. Premolars and mesiobuccal root of first molar are innervated by middle superior alveolar nerve. Molars are innervated by posterior superior alveolar nerve.

## MULTIPLE CHOICE QUESTIONS (MCQs)

1. The mental foramen on each side lies near the apex of the
  - a. Mandibular canine
  - b. Mandibular first premolar
  - c. Mandibular second premolar
  - d. In between mandibular first and second premolar
2. The mental foramen in most humans is located superior to the inferior border of the mandible at a distance of
  - a. 10–12 mm
  - b. 8–10 mm
  - c. 13–15 mm
  - d. 6–8 mm
3. The single, bilaterally symmetrical, movable, bone of the skull is
  - a. Maxilla
  - b. Temporal
  - c. Mandible
  - d. Occipital
4. The carotid artery that supplies the mouth
  - a. External carotid
  - b. Internal carotid
  - c. Both a and b
  - d. Middle carotid
5. The blood supply to maxillary and mandibular teeth is by
  - a. Mandibular part of maxillary artery
  - b. Anterior tympanic
  - c. Middle meningeal
  - d. Laryngeal
6. The inferior alveolar artery supplies
  - a. Maxillary molars
  - b. Mandibular molars and premolars
  - c. Both a and b
  - d. Maxillary central incisor
7. The symphyseal cartilage ossifies
  - a. Before birth
  - b. At birth
  - c. One year after birth
  - d. At 21 years of age
8. Lymph from mandibular posterior teeth is drained into
  - a. Submental lymph nodes
  - b. Submandibular lymph nodes
  - c. Submental and submandibular lymph nodes
  - d. Cervical lymph nodes
9. Branches of maxillary artery that supply the temporomandibular Joint are
  - a. Anterior tympanic
  - b. Masseteric
  - c. Middle meningeal
  - d. All the above
10. The facial nerve is
  - a. Sensory nerve
  - b. Motor nerve
  - c. Mixed nerve
  - d. None of the above
11. Mandibular torus is found on the
  - a. Labial side of the mandible
  - b. Lingual side of the mandible
  - c. Angle of the mandible
  - d. Lower border of the mandible.
12. Mandible is a following type of bone
  - a. Intracartilagenous
  - b. Intracartilagenous and intramembranous
  - c. Intramembranous
  - d. None of the above
13. The sections of the teeth clearly seen on standard radiographs are
  - a. The labial and buccal longitudinal sections
  - b. The mesial and distal aspect of longitudinal sections
  - c. Both
  - d. None of the above

1-c, 2-c, 3-c, 4-a, 5-a, 6-b, 7-c, 8-b, 9-d, 10-c, 11-b, 12-b, 13-a

14. The lingual plate is paper thin over the lingual alveolus of the
- Maxillary first molar
  - Maxillary premolar
  - Maxillary second and third molars
  - Mandibular molars
15. Mandibular anterior teeth have sensory nerve supply from
- Superior alveolar nerve
  - Inferior alveolar nerve
  - Lingual nerve
  - Buccal nerve
16. Lower lip gets sensory nerve supply from
- Buccal branch of facial nerve
  - Mandibular branch of facial nerve
  - Buccal branch of mandibular nerve
  - Mental nerve
17. Buccinator muscle receives its motor nerve supply from
- Zygomatic branch of facial nerve
  - Buccal branch of trigeminal nerve
  - Buccal branch of facial nerve
  - Mandibular branch of facial nerve.
18. Hypoglossal nerve is motor nerve for all the muscles of tongue except
- Superior longitudinal muscle
  - Inferior longitudinal muscle
  - Genioglossus
  - Palatoglossus
19. The line of posterior alveoli of mandibular teeth are inclined
- Labially
  - Lingually
  - Not inclined, are straight
  - Mesially
20. The mandibular anterior teeth have alveoli tipped
- Labially
  - Lingually
  - Not tipped
  - Mesially
21. The bone buccal to last two molars in mandible is
- Very heavy and thick
  - Very thin
  - Moderately thick
  - Moderately thin
22. Mandible is formed by
- Endochondral ossification method only
  - Intramembranous ossification
  - Both endochondral and intramembranous ossification
  - None of the above
23. The sutural junction where frontal and parietal bones unite is termed
- Nasion
  - Bregma
  - Lamboid
  - Frontion
24. Lingula is the projection of bone on the following part of the mandible
- Medial aspect of vertical ramus of mandible
  - Inner aspect of mandible at midline
  - Outer aspect of mandible near mental foramen
  - None of the above
25. Genial tubercles are the tiny projections of the bone present in
- Inner aspect of mandible near mylohyoid ridge
  - External surface of mandible near symphysis menti
  - Inner aspect of mandible at midline
  - The lingula
26. Lingual foramen is present on
- Inner aspect of vertical ramus
  - Outer aspect of mandible near premolar region
  - Inner aspect of mandible near midline
  - The symphysis menti
27. Lymph drainage from all the following structures go to submandibular lymph nodes, except
- Mandibular teeth
  - Occipital part
  - Tongue
  - Maxillary teeth

14-a, 15-b, 16-d, 17-c, 18-d, 19-b, 20-a, 21-a, 22-c, 23-b, 24-a, 25-c, 26-c, 27-b

# Muscles of Mastication

## SAQs (3 Marks)

**Q 1. Enumerate and describe muscles of mastication.** (Oct. 2002, 2003, June 2005, 2006)

**Ans. Muscles of Mastication**

- The masticatory muscles surrounding the joint are group of muscles that contract and relax in harmony so that the jaws function properly.
- There are four pairs of muscles of mastication, masseter, temporalis, medial pterygoid, and lateral pterygoid.

### Masseter

- It is the principal and strongest muscle of mastication, which stems from the temporal bone and extends down the outside of the mandible to its lower angle. It consists of two overlapping heads:
- **Origin:** Zygomatic arch.
- **Insertion:** Lateral surface of ramus, angle and border of mandible.
- **Nerve supply:** Masseter nerve.
- **Function:** To close the jaw and apply power in crushing food.

### Temporalis Muscle

- It is a fan-shaped muscle and the largest masticatory muscle that fills the temporal fossa.
- **Origin:** Temporal fossa and the overlying temporal fascia.
- **Insertion:** Coronoid process of mandible, anterior border of ramus and temporal crest of mandible via one common tendon.
- **Nerve supply:** Temporal branch of mandibular nerve.
- **Function:** Its anterior fibers help in elevation of mandible. Its posterior fibers help in retracting the protruded mandible.

### Medial Pterygoid Muscle

- It runs parallel to the masseter muscle but on the inside of the jaw.
- **Origin:** From the medial surface of the lateral pterygoid plate.
- **Insertion:** On the medial surface of mandible in the triangular region just above the angle.



- **Nerve supply:** The nerve to the medial pterygoid, a branch of main trunk of mandibular teeth.
- **Function:** Elevation and protrusion of mandible.

### Lateral Pterygoid Muscle

- It is a short conical muscle and has upper and lower heads.
- **Origin:** Sphenoid bone.
- **Insertion:** Into the neck of condyle.
- **Nerve supply:** Branch of anterior division of mandibular nerve.
- **Function:** In opening of the jaw, in protrusion and lateral movements of mandible.

### Q 2. What is Mastication?

(July 2005)

#### Ans. Mastication

- It is a complex rhythmical activity that requires coordination of the neuromusculature. It is the cutting down of food substances in small particles and grinding them into a small bolus.
- Mastication is a repetitive sequence of jaw opening and closing with a profile in the vertical plane called the 'chewing cycle'.
- Mastication consists of number of chewing cycles opening phase, closing phase, occlusal or intercuspal phase.
- Each chewing cycle lasts approximately for .8 to 1.0 sec.
- During normal function 7 to 15 kg force occurs during swallowing and chewing.
- The act of mastication begins with "setting the system" by sight, tactile sense and smell to receive the food.
- When food is taken into mouth, the lips, tongue and periodontium function to estimate size, hardness, etc. of food.
- This information sets the chewing program in pattern.
- Chewing is highly complex.
- The duration of chewing cycle varies between 1 to 6 sec, depending on the type of food.
- Speed, duration and form of the chewing cycle vary with the type of occlusion, kind of food, and presence of dysfunction.

## MULTIPLE CHOICE QUESTIONS (MCQs)

1. Retraction results from the bilateral contraction of the
  - a. Medial pterygoid
  - b. Lateral pterygoid
  - c. Posterior fibers of the temporalis muscle
  - d. Masseter
2. Protraction results from the simultaneous contraction of
  - a. Right and left medial pterygoid
  - b. Right and left lateral pterygoid
  - c. Temporalis
  - d. Buccinator
3. Sideway movement of mandible results from the contraction of
  - a. One lateral pterygoid muscle on opposite side
  - b. One medial pterygoid muscle on opposite side
  - c. Pterygoid muscle
  - d. Temporalis
4. In the opening of the mouth, all of the following muscles take part, *except*
  - a. Temporalis
  - b. Platysma
  - c. Digastric
  - d. Lateral pterygoid
5. Muscle attached to articular disc is
  - a. Lateral pterygoid
  - b. Medial pterygoid
  - c. Masseter
  - d. Temporalis
6. The muscle which moves the disc of the TMJ forward is
  - a. Lateral pterygoid
  - b. Medial pterygoid
  - c. Temporalis
  - d. Masseter
7. Contraction of posterior fibres of temporalis muscle results in
  - a. Retrusion
  - b. Protrusion
  - c. Opening
  - d. Closing
8. The position in which there is relative muscular equilibrium is
  - a. Retruded contact position
  - b. Postural position
  - c. Protruded contact position
  - d. None of the above
9. Except one pair all the following are jaw elevators
  - a. Masseter
  - b. Temporalis
  - c. Medial pterygoid
  - d. Lateral pterygoid
10. All the following muscles are elevators of mandible *except*
  - a. Masseter
  - b. Digastric
  - c. Temporalis
  - d. Medial pterygoid
11. Medial pterygoid takes its origin on
  - a. Medial surface of lateral pterygoid plate (sphenoid bone)
  - b. External pterygoid plate
  - c. Styloid process
  - d. Zygoma
12. Buccinator muscle receives its motor nerve supply from
  - a. Zygomatic branch of facial nerve
  - b. Buccal branch of trigeminal nerve
  - c. Buccal branch of facial nerve
  - d. Mandibular branch of facial nerve
13. The following muscles take their origin on medial surface of mandible *except*
  - a. Medial pterygoid muscle
  - b. Mylohyoid muscle
  - c. Genioglossus muscle
  - d. Superior constrictor

1-c, 2-b, 3-a, 4-a, 5-a, 6-a, 7-a, 8-b, 9-d, 10-b, 11-a, 12-c, 13-d

14. The combined pull of two lateral pterygoid muscles along with the anterior bellies of the two digastric and the other suprahyoid muscles will result in
- Protrusion
  - Retrusion
  - Closing
  - Opening of mandible
15. The fan shaped large and flat muscle is
- Buccinator
  - Temporalis
  - Masseter
  - Medial pterygoid
16. Out of the four pairs of muscles of mastication the only pair of muscle which is oriented horizontally is
- Medial pterygoid
  - Lateral pterygoid
  - Masseter
  - Temporalis
17. Closing of the mouth (elevation) results from the bilateral contraction of
- Right and left temporalis
  - R and L masseter
  - R and L medial pterygoid
  - All of the above
18. Opening of mouth (depression) results from the bilateral contraction of
- Both lateral pterygoid
  - Masseter
  - Medial pterygoid
  - Buccinator
19. During the opening of mouth there is
- Only translation movement
  - Only hinge movement
  - First hinge and then translation movement
  - Sliding movement
20. Temporalis muscle performs the function of
- Elevation
  - Retraction
  - Clenching
  - All of the above
21. The most superficial bulky and powerful muscle of mastication is
- Temporalis
  - Masseter
  - Medial pterygoid
  - Lateral pterygoid
22. The muscle which is not antigravity muscle is
- Masseter
  - Temporalis
  - Medial pterygoid
  - Lateral pterygoid

# Deglutition

## SAQs (3 Marks)

### Q 1. Define deglutition.

(Oct. 2004, July 2005, June 2007, May 2009, 2013)

**Ans. Swallowing of food is known as deglutition:**

Deglutition occurs in 3 stages, namely.

1. Oral stage—when food enters from mouth into pharynx.
  2. Pharyngeal stage—when food enters esophagus from pharynx.
  3. Esophageal stage—when food enters stomach from esophagus.
- **Oral stage:** It is preceded by mastication. The passage of food through oral cavity into the pharynx occurs in this stage. This is a voluntary stage.
  - **Pharyngeal or second stage:** In this stage, the bolus is pushed from pharynx into the esophagus. It is an involuntary stage.

The pharynx is a common passage for food and air.

It divides into larynx and esophagus.

Larynx lies anteriorly and continues as respiratory passage. Esophagus lies behind the larynx and continues as GIT.

During this stage of swallowing, the bolus can enter 4 ways into the pharynx, which are:

- a. Back into mouth
- b. Upward into nasopharynx
- c. Forward into larynx
- d. Downward into the esophagus.

The various movements are coordinated so that the bolus enters only the esophagus.

The entrance of bolus through other outlets is prevented as follows:

- a. Back into mouth is prevented by position of the tongue and the high intraoral pressure created by the movement of the tongue.
- b. Upward into nasopharynx is prevented by elevation of soft palate.
- c. Forward into larynx is prevented by:
  - Approximation of vocal cords.
  - Forward and upward movement of larynx.

- Backward movement of epiglottis to close the larynx and by temporary arrest of breathing.
- This occurs during second stage of swallowing and apnea during deglutition is called “deglutition apnea”, or “swallowing apnea”.

d. Entrance of bolus into esophagus.

As the other three paths are closed for the Bolus, it has to only pass through the esophagus. This occurs by the combined effects of various factors:

- Upward movement of the larynx.
- Relaxation of upper 3–4 cm of esophagus.
- Peristaltic contraction in the pharynx.
- Lifting away of glottis from the food passage due to elevation of larynx.

The whole process takes place within 1–2 sec and this process is purely involuntary.

- **Esophageal or third stage:** This is also an involuntary stage.

The function of esophagus is to transport the food from pharynx to the stomach.

The movements of esophagus are specifically organized for this function and these movements are called “peristaltic waves”, which propel the bolus into the stomach.

## Q 2. What is speech regulatory center?

(June 2007)

**Ans. Speech Regulatory Center**

- Speech is one of the functions of the upper aerodigestive tract and is an activity that involves nerves, muscles, and mechanical factors such as movement of air and hearing.
- Speech is produced and modified in the vocal tracts.
- The term language center refers to the area of the brain which serves a particular function for speech processing and production. *For example*, Broca’s area and Wernicke’s area.
- Most areas of speech processing develop in second year of life in the dominant half (hemisphere) of the brain, which corresponds to the opposite of dominant hand. Ninety eight percent of right handed people are left hemisphere dominant and majority of left hand people as well.
- Broca’s area is located in left inferior frontal cortex (left cerebral hemisphere in the inferior frontal gyrus of the frontal lobe).
- Wernicke’s area is located in the superior temporal gyrus of the temporal lobe.
- Broca’s area is an speech production center with motor functions.
- Wernicke’s area is a language center with motor comprehension center which is next to primary auditory cortex. It controls meaningful or logical speech.
- The cranial nerves involved in speech production are V, VII, X, XII.

**MULTIPLE CHOICE QUESTIONS (MCQs)**

1. The process of preventing entry of food bolus into the respiratory tract in the pharyngeal stage is known as
  - a. Respiration of swallowing
  - b. Deglutition apnea
  - c. Both
  - d. None
2. Muscle that closes nasopharynx during deglutition is
  - a. Levator palate
  - b. Tensor palate
  - c. both a and b
  - d. Palato glossus
3. The number of times swallowing takes place per day in an individual is approximately
  - a. 600 times
  - b. 60 times
  - c. 6000 times
  - d. 1600 times
4. The stage of deglutition which is voluntary is
  - a. Pharyngeal
  - b. Esophageal
  - c. Oral
  - d. Both a and b
5. Respiration stops for a while in the following phase of swallowing
  - a. Esophageal
  - b. Oral
  - c. Pharyngeal
  - d. Both b and c
6. Newborn and infants feed by a process called
  - a. Suckling
  - b. Sucking
  - c. Mastication
  - d. All of the above
7. Irritation or noxious stimulation of the posterior of the oral cavity results in the following reflex
  - a. Swallowing
  - b. Masticatory
  - c. Suckling
  - d. Vomiting

1-b, 2-c, 3-a, 4-c, 5-d, 6-a, 7-d

# Temporomandibular Joint

## SAQs (3 Marks)

### Q 1. Describe ligaments of temporomandibular joint.

(June 2004, Nov. 2010, 2014, 2015, May 2012, Oct. 2015)

#### Ans. Ligaments of Temporomandibular Joint

- The TMJ has one major and three minor ligaments.
- The temporomandibular ligament is the major ligament.
- The sphenomandibular ligament, the stylomandibular ligament and pterygomandibular raphae are minor ligaments.
- **The temporomandibular ligament** (lateral ligament) strengthens the joint capsule. It is infact the thickened lateral portion of the capsule.
- The function of this ligament is to provide the main support to the joint and to resist dislocation during functional movements.
- **Sphenomandibular ligament** is a flat, thin band which is attached to the spine of the sphenoid above and to the lingula of the mandible below.  
The function of this ligament is to limit distension of the mandible in an inferior direction.
- **Stylomandibular ligament:** This ligament is a specialized band or the free border of the cervical fascia which extends from the apex of the styloid process of the temporal bone to the posterior border of the angle of the mandible, between the masseter and internal pterygoid.  
This ligament along with the sphenomandibular ligament, limits excessive opening of the mandible.
- **Pterygomandibular raphae:** It is a tendinous band of the buccopharyngeal fascia attached by one extremity to the hamulus of the medial pterygoid plate and by the other extremity to the posterior end of the mylohyoid line of the mandible.

### Q 2. What is synovial membrane?

(Oct. 2004)

#### Ans. Synovial Membrane

- The synovial membrane is a thin and flexible layer lining the inner surface of the capsule. It covers all the intraarticular surfaces except pressure-bearing fibrocartilage.
- The synovial membrane consists of two layers.  
The cellular intima layer and the vascular sub-intima layer.
- Function of synovial membrane is to produce fluid which helps in lubricating the joint, repairing the wear.

**MULTIPLE CHOICE QUESTIONS (MCQs)**

1. During the opening of mouth there is
  - a. Only translation movement
  - b. Only hinge movement
  - c. First hinge and then translation movement
  - d. Sliding movement
2. Temporomandibular joint is found in
  - a. Only mammals
  - b. Reptiles
  - c. Amphibians
  - d. Mammals and reptiles
3. Synovial membrane is present in
  - a. Temporomandibular joint
  - b. Knee joint
  - c. Wrist joint
  - d. All of the above
4. Capsule of TMJ is weakest
  - a. Anteriorly
  - b. Laterally
  - c. Medially
  - d. Posteriorly
5. The only ligament that gives direct support to the capsule of the TMJ is
  - a. Sphenomandibular ligament
  - b. Stylomandibular ligament
  - c. Temporomandibular ligament
  - d. None of the above
6. The amount of synovial fluid
  - a. Increases with age
  - b. Decreases with age
  - c. Does not depend on age
  - d. None of the above
7. The articular surface of TMJ is made-up of
  - a. Vascular fibrous tissue
  - b. Calcific tissue
  - c. Hyaline tissue
  - d. None of the above
8. Meniscus of TMJ in older person is
  - a. Synovial
  - b. Cartilagenous
  - c. Fibrocartilagenous
  - d. Fibrous
9. Muscle attached to articular disc is
  - a. Lateral pterygoid
  - b. Medial pterygoid
  - c. Masseter
  - d. Temporalis
10. The muscle which moves the disc of TMJ forward is
  - a. Lateral pterygoid
  - b. Medial pterygoid
  - c. Temporalis
  - d. Masseter
11. The articulation between the movable mandible and the stationary skull is known as
  - a. Temporomandibular joint
  - b. Craniomandibular joint
  - c. Both a and b
  - d. Gomiohosis
12. The mandible functions as which type of lever
  - a. Class I
  - b. Class II
  - c. Class III
  - d. Class IV
13. Medially and laterally, the articular disc is attached to
  - a. Lateral pterygoid
  - b. Squamotympanic fissure
  - c. Condylar neck
  - d. Joint capsule
14. Glenoid fossa is
  - a. Central fossa of mandibular first molar
  - b. Articulating surface of mandibular condyle
  - c. Depression in maxilla distal to canine fossa
  - d. None of the above

1-c, 2-a, 3-d, 4-c, 5-c, 6-b, 7-c, 8-d, 9-a, 10-a, 11-c, 12-c, 13-d, 14-b



- 15. TMJ is capable of performing full opening movements and slight gliding movements and this type of joint can be described as**
- Ball and socket joint
  - Hinge joint
  - Pivot joint
  - Condylar joint
- 16. Contraction of lateral pterygoid causes meniscus to move forwards and this results**
- Posterior movement of condyles in the glenoid fossa
  - Forward and downward movement of the condyles
  - Forceful closure of the mandible
  - None of the above
- 17. Which of the following protects TMJ in function?**
- Synovial fluid
  - Ligaments of the capsule
  - Muscles of mastication
  - All of the above
- 18. When mandible is brought forward to make edge to edge contacts there is both hinge and gliding movements. The condyles contacts there is both hinge and gliding movements. The condyles in the glenoid fossa moves.**
- Forward only
  - Backward only
  - Forwards and downwards
  - Forwards and upward.
- 19. The movement that occurs during opening of mandible from retruded contact position is**
- Hinge movement only
  - Sliding movement
  - Hinge followed by sliding
  - Sliding followed by hinge
- 20. The stylomandibular ligament of TMJ is attached**
- Above to the lateral surface of the styloid process
  - Below to the angle and posterior border of the ramus of the mandible
  - Both a and b
  - None of the above
- 21. TMJ gets its blood supply from**
- Branches from superficial temporal and maxillary arteries
  - Branches from mandibular arteries
  - External carotid artery
  - Mental artery
- 22. TMJ gets its nerve supply/TMJ is innervated by**
- Auriculotemporal nerve
  - Masseter nerve
  - Both a and b
  - None of the above

# Maxillary Sinus

## SAQ (3 Marks)

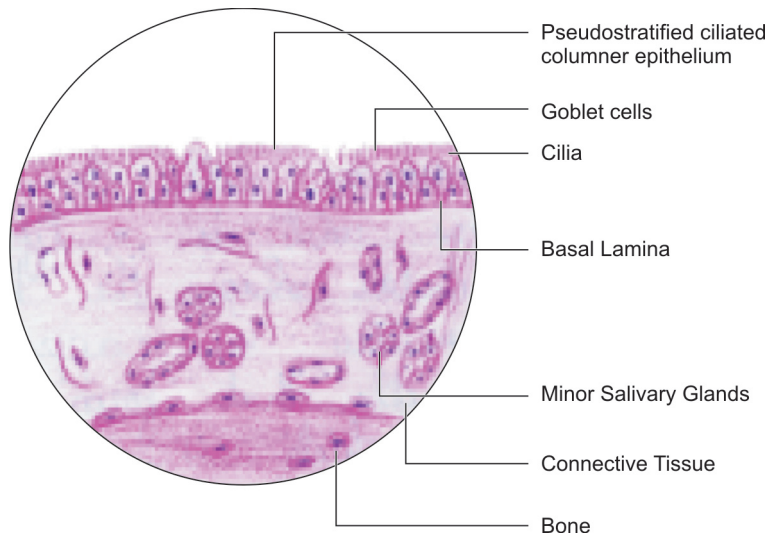
**Q 1. Describe maxillary sinus.**

(June 2008)

**Ans.**

- It is also called “maxillary antrum”, and the “antrum of Highmore”.
- It is the pneumatic space that is lodged inside the body of the maxilla and it communicates with the environment by way of the middle nasal meatus and the nasal vestibule.
- It is large, four-sided, pyramid-shaped cavity. Its size is  $25 \times 30 \times 30$  mm. Capacity of 15 ml or about 1 tablespoon.
- The sinus cavity floor extends inferiorly into the base or top of the alveolar process where many projections of the apical ends of the molar roots and sometimes, premolar roots are found.
- **Histology of maxillary sinus:**
  - Microscopically three layers surround the maxillary sinus space—the epithelial layer, basal lamina, and subepithelial layer including periosteum.
  - The epithelium is pseudostratified, columnar and ciliated. The most numerous cellular type is columnar ciliated epithelial cell.
  - In addition basal cells, columnar nonciliated cells, and Goblet cells are also seen.
  - A **ciliated** cell has nucleus and cytoplasm with numerous mitochondria and enzyme containing organelles. The cilia are typically composed of 9+1 pairs of microtubules and they provide the motile apparatus to the sinus epithelium. By way of ciliary beating the mucous blanket lining the epithelial surface moves from sinus toward nasal cavity.
  - The **Goblet cell** displays all of the characteristic features of a secretory cell. In the basal segment of the cell is the nucleus, rough, and smooth endoplasmic reticulum and golgi apparatus. All of which are involved in the synthesis of secretory mucosubstances. From the golgi apparatus the zymogenic granules transport the mucopolysaccharides toward the cellular apex and finally release this material onto the epithelial surface by exocytosis.
  - In addition to the epithelial secretion, the surface of the sinus is provided with a mixed secretory product from the subepithelial glands. These are located in the subepithelial layer of the sinus and reach the sinus lumen by way of excretory ducts. Acini of subepithelial glands has varying proportions of serous and mucous cells.

- **Functions:**
  - Lighten the skull, give resonance to voice, warm the air we breathe, moisten the nasal cavity.
  - It enhances faciocranial resistance to mechanical shock.
- **Clinical considerations:**
  - Agenesis, aplasia or hypoplasia of the maxillary sinus occurs either alone or in association with other anomalies, e.g. cleft palate, high palate, and septal deformity.
  - Since upper first molar is very close to the floor of maxillary sinus, surgical manipulation on this tooth breaks the bony lamina and creates an oroantral fistula.



**Fig. 12.1:** Maxillary sinus

**MULTIPLE CHOICE QUESTIONS (MCQs)**

- 1. Opening of maxillary sinus is situated in**
  - a. Superior meatus
  - b. Middle concha
  - c. Inferior meatus
  - d. Hiatus semilunaris
- 2. Maxillary sinus is lined with**
  - a. Squamous cell epithelium
  - b. Columnar epithelium
  - c. Pseudostratified ciliated columnar epithelium
  - d. Stratified squamous epithelium
- 3. The largest sinus is**
  - a. Maxillary
  - b. Frontal
  - c. Ethmoid
  - d. Sphenoid
- 4. The first formed sinus is**
  - a. Maxillary      b. Frontal
  - c. Ethmoid      d. Sphenoid
- 5. The paranasal sinus which is not paired is**
  - a. Maxillary      b. Frontal
  - c. Ethmoid      d. Sphenoid
- 6. The maxillary sinus communicates with the environment by**
  - a. Superior nasal meatus
  - b. Middle nasal meatus
  - c. Middle nasal meatus and nasal vestibule
  - d. Inferior nasal meatus
- 7. The secretory cells present in the sub-epithelial glands of maxillary sinus are**
  - a. Mucous cells
  - b. Serous cells
  - c. Both of the above
  - d. None of the above
- 8. The functions of maxillary sinus are**
  - a. Protect the internal structures against exposure to cold air
  - b. Contribute resonance to voice
  - c. Mastication
  - d. Both a and b
- 9. The maxillary sinus is also called as**
  - a. Antrum of maxilla
  - b. Antrum of mandible
  - c. Antrum of highmore
  - d. Antrum of lowmore

1-d, 2-c, 3-a, 4-a, 5-d, 6-c, 7-c, 8-d, 9-c