Innovated dental anatomy for dental technician

By
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Acknowledgments

This two-year curriculum was developed through a participatory and collaborative approach between the Academic faculty staff affiliated to Egyptian Universities as Alexandria University, Ain Shams University, Cairo University , Mansoura University, Al-Azhar University, Tanta University, Beni Souef University , Port Said University, Suez Canal University and MTI University and the Ministry of Health and Population(General Directorate of Technical Health Education (THE). The design of this course draws on rich discussions through workshops. The outcome of the workshop was course specification with Indented learning outcomes and the course contents, which served as a guide to the initial design.

We would like to thank **Prof.Sabah Al- Sharkawi** the General Coordinator of General Directorate of Technical Health Education, **Dr. Azza Dosoky** the Head of Central Administration of HR Development, **Dr. Seada Farghly** the General Director of THE and all share persons working at General Administration of the THE for their time and critical feedback during the development of this course.

Special thanks to the **Minister of Health and Population Dr. Hala Zayed and Former Minister of Health Dr. Ahmed Emad Edin Rady** for their decision to recognize and professionalize health education by issuing a decree to develop and strengthen the technical health education curriculum for pre-service training within the technical health institutes.

Contents

Course Specifications

١ ـ بيانات المقرر		
الرمز الكودى :	اسم المقرر :Dental anatomy	الفرقة /المستوى :الثانية
التخصص :	عدد الوحدات الدراسية : نظرى 2 عملى 1	

2- Overall Aim of Course:	- To promote advanced knowledge about dental anatomy. - To provide expanded knowledge about human dentition. - To serve as a base for construction of artificial teeth for the practical work for Removable Prothodontics as well as Fixed Prothodontics. - To expand the hand skills of the students **To develop appropriate professional attitude and communication.**
3- **Intended learning outcomes of the course (ILOs):**	
i. Knowledge and Understanding:	**Upon successful completion of this course the students will be able to:** a1- Define the different parts of the oral cavity. a2- Describe macro- and micro-anatomy of the teeth. a3- Select the appropriate tooth identification system needed in any dental practice. a4- Identify deciduous and permanent teeth. a5- State the significance of physiologic tooth form in protecting the periodontium.
ii. Intellectual Skills:	**Upon successful completion of this course the students will be able to:** **b1-Differentiate between upper and lower permanent human teeth.** **b2-Differentiate between the different types of human permanent teeth.** **b3-Differentiate between permanent and deciduous dentitions.**
III. Professional Skills:	**Upon successful completion of this course the students will be able to:** c1-Construct the normal shape and size of some permanent human teeth by carving. c2-Rebuild variable destructed surfaces of permanent human teeth on stone cast models of natural oral size. **c3-Differentiate between different types of human teeth.**
IV. General and Transferable Skills:	**Upon successful completion of this course the students will be able to:**

	d1- Communicate effectively with colleagues, staff members and helping personnel. **d2- Demonstrate appropriate professional attitude and behavior in different situations.** **d3- Practice independent learning by using information technology tools.** **d4- Evaluate information from various standard sources to improve professional skills.**
4- Course content	1. Introduction about the oral cavity and teeth 2. The dentitions of human being 3. Tooth anatomy 4. Tooth identification systems 5. Anatomical landmarks of the crowns 6. Surface anatomy of permanent teeth 7. Surface anatomy of deciduous teeth 8. Geometric outline of the crowns and their significance.
5- Teaching and Learning Methods:	**1. Lectures.** **2. Group discussions.** 3. **Practical sessions.**
6- Teaching and learning methods for students with limited abilities.	**If it is a must to accept disable students they should have certain characters as they will deal with flames and wax carvers and knives. As examples they should;** **1- Able to move their hands well.** **2- Be mentally graded well.** **3- See properly.** **For these students regular Teaching and learning methods could be used.**
7- Student Assessment:	
a- Assessment methods:	**a. Class work:** **1. Quizzes** **2. Midterm theoretical** **3. Practical exam** **4. Assignments** **5. Participation** **b. Final exam:** **Theoretical and practical.**
b- Assessment schedule:	**a. Class work:** **1. Quizzes:** **Quiz I ; theoretical (5 marks) and practical (5 marks) (4th week).** **Quiz II; theoretical (5 marks) and practical (5 marks) (11th week).** **2. Assignments (Carved teeth in the class (5 marks) every week)** **b. Midterm theoretical (10 %) and practical (15%) (7th week).** **c. Final exams** **Practical exam (13th week)** **written theoretical exam (15th week)**
C-Weight Of	

Assessments:	**a. Class work (25%), 25 marks** **b. Midterm (theoretical (10 %) and practical (15%) (25 marks)** **c. Final exams;** **Practical (15%), 15 marks.** **Final written theoretical exam (35%), 35 marks.** **Total percentage 100%**

7- List of References:

a- Course notes:	**Lectures, Innovated dental anatomy for dental technicians and practical notes for dental anatomy**
b- Essential books (text books)	***Wheeler's (Dental anatomy, physiology and occlusion) 10th edition, 2015** *Woelfel's Dental Anatomy: Its Relevance to Dentistry **By Aurangzaib Baloch** **December 24, 2017**
c- Recommended books	**Illustrated dental embryology, histology and anatomy 4th edition, 2015 (Margaret Fehrenbach, Tracy Popowics**
d- Periodicals, web sites, ,,,,,	• www.google.com • www.pubmed.com • www.biomed.net

Course Description

This course concerned with developing the knowledge related to anatomy of the teeth both permanent and deciduous. Dental anatomy course also provides presentation of dental macro-morphology; moreover expand the hand skills of dental technician students as well as the development and application of appropriate professional attitude and communication.

The basic knowledge in this course will assist students in building up learning strategies, approaching and understanding practically applied dental courses. This course also adds to the student's ability to evaluate different types of artificial fixed or removable restorations in the labs before introducing them to the patients in the clinics.

Core Knowledge

Upon successful completion of this course the students will be able to:

- Define the different parts of the oral cavity.
- Describe macro and micro-anatomy of the teeth.
- Select the appropriate teeth identification system needed in any dental practice.
- Identify deciduous and permanent teeth.
- State the significance of physiologic tooth form in protecting the periodontium.

Core Skills

Upon successful completion of this course the students will be able to:

- Differentiate between upper and lower permanent human teeth.
- Differentiate between the different types of human permanent teeth.
- Differentiate between permanent and deciduous dentitions.
- Construct the normal shape and size of some permanent human teeth by carving.
- Rebuild variable destructed surfaces of permanent human teeth on stone cast models of natural oral size.
- Differentiate between different types of human teeth.
- Communicate effectively with colleagues, staff members and helping personnel.
- Demonstrate appropriate professional attitude and behavior in different situations.
- Practice independent learning by using information technology tools.

- Evaluate information from various standard sources to improve professional skills.

Course Overview

		Methods of Teaching / Training with Number of Total Hours per Topic				
ID	Topics	Interactive Lecture	Field Work	Class Assignments	Research	Lab
1	Introduction	1				1
2	Surface anatomy of permanent anterior teeth	4				6
3	Surface anatomy of premolars	2				2
4	Surface anatomy of permanent molars	4				2
5	Surface anatomy of deciduous teeth	1				
	TOTAL HOURS (23)	**12**				11

Chapter 1
Introduction

Objectives

-Define the different parts of the oral cavity.

-Describe macro-anatomy of the teeth.

-Select the appropriate teeth identification system needed in any dental practice.

Parts of the oral cavity: (Figs. 1 and 2)

1) **Lips:**

• There are two lips upper and lower.

• Related grooves;

a. Nasolabial groove.

b. Labiomental groove.

2) **Gingiva:**

The pink tissue that covers the cervical part of the teeth.

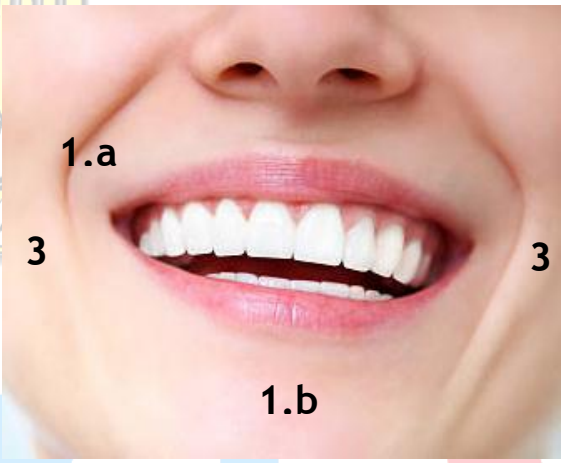


Fig. 1: Upper and lower lips with the related grooves (1.a- 1. b) and cheek (3).

3) **Cheek.**

4) **Tongue.**

5) **Floor of the mouth.**

6) **Roof of the mouth (Palate).**

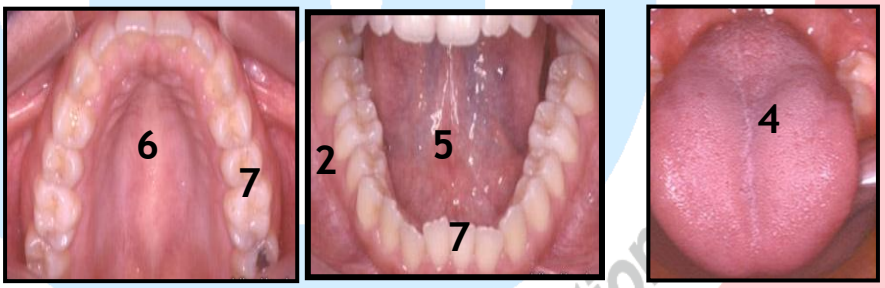


Fig. 2: Gingiva (2), tongue (4), floor of the mouth (5), palate (6) and teeth (7).

7) **Teeth** (Fig. 3)**.**

Human teeth are arranged in two arches called dental arches one upper (maxilla) and one lower (mandible).

• The teeth of upper dental arch are called **upper** or **maxillary** teeth.

• The teeth of lower dental arch are called **lower** or **mandibular** teeth.

• Each dental arch can be divided into equal halves by a **midline**.

- Thus there are four quadrants in the entire oral cavity.

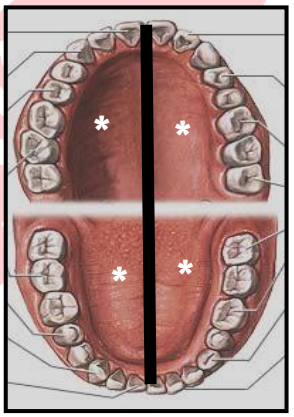


Fig. 3: Upper and lower jaws with related teeth, a midline and 4 quadrants (*).

- **Types of teeth** (Fig. 4):

1-Incisors:
There are two incisors in each quadrant, ***central*** incisor and ***lateral*** incisor.
2- Canines:
There is ***one*** canine in each quadrant

Note; incisors and canines are called **Anterior Teeth.**

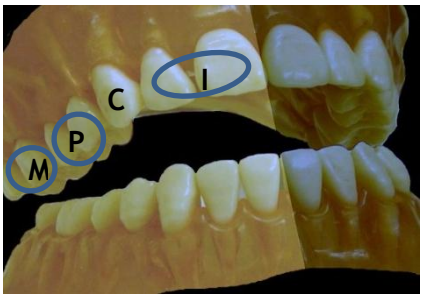


Fig. 4: Incisors (I), canine (C), premolars (P) and molars (M).

3-Premolars:
There are two in each quadrant, ***first*** and ***second*** premolars.
4-Molars:
There are three in each quadrant, ***first***, ***second*** and ***third*** molars.

Note; premolars and molars are called **Posterior teeth.**

- **Functions of teeth:**

1-Mastication; incisors are designed for ***incising*** or ***cutting,*** canines are designed for ***cutting*** and ***tearing,*** premolars are designed for ***tearing*** and ***grinding*** while molars are designed for ***grinding.***
2-Appearance; well-arranged clean teeth with proper alignment give nice appearance to the face. Teeth give also support to the facial expressions.
3- Speech; teeth are important for clear pronunciation and for production of sound.
4- Growth of jaws; the teeth play a role in the growth of the jaws during eruption period.

Overview of dentition

- **Types of Dentitions** (Fig. 5):

Humans have two dentitions; **primary** (deciduous) and **permanent** (adult) dentitions. When both dentitions exist in the oral cavity it will be **mixed** dentition.

Fig. 5: Human dentition; Deciduous (D), Mixed (M) and Permanent (P)

- **Primary dentition**(Fig. 6): starts from **6 month** till **6 years**

20 teeth (5 in each quadrant); 2 incisors, 1 canine and 2 molars.

The dental formula is:

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

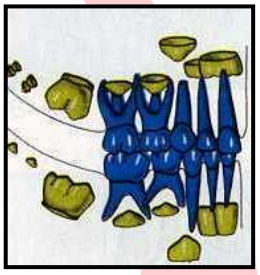


Fig. 6: Primary dentition.

- **Permanent dentition** (Fig. 7): starts after **12 years**

32 teeth (8 in each quadrant); 2 incisors, 1 canine, 2 premolars and 3 molars.

The dental formula is:

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

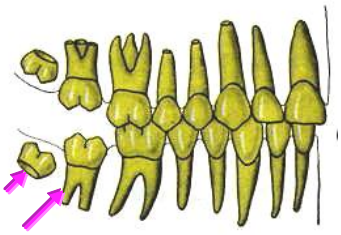


Fig. 7: Mixed dentition.

Note; 1- *Premolars* come after shedding of deciduous molars.
2- The *permanent molars* erupt in the jaw and are not preceded with deciduous teeth so they may be termed as *non-succedaneous teeth*.

- **Mixed dentition** (Fig. 8): starts from 6 years till 12 years.

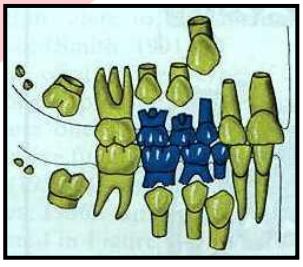


Fig. 8: Mixed dentition.

Tooth identification system

To identify a specific tooth should mention:
1-Types of dentition (permanent or deciduous)
2-The arch (upper or lower)
3-The quadrant (right or left)
4-The name of the tooth

1) <u>Palmer Notation System</u> (Fig. 9):

- The ***permanent teeth*** are numbered from 1-8 on each side from the midline.

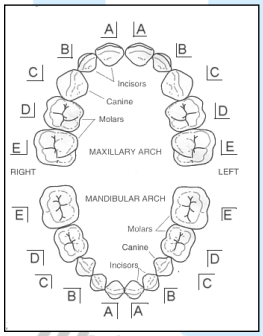
***Upper* right**								**Upper left**							
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Lower right								***Lower left***							

3 ⌋ upper right permanent canine

- The ***deciduous teeth*** are lettered from A-E on each side from the midline.

Upper right					***Upper left***				
E	D	C	B	A	A	B	C	D	E
E	D	C	B	A	A	B	C	D	E
Lower right					***Lower left***				

C ⌋ upper right deciduous canine



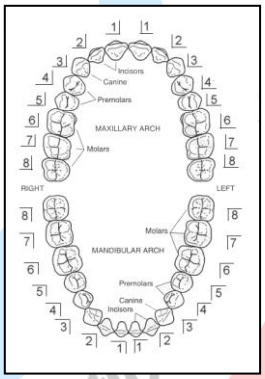
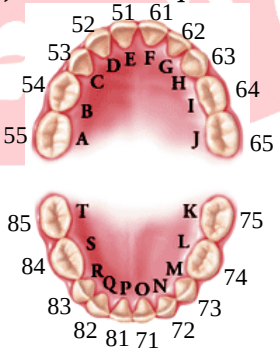


Fig. 9: Palmer Notation System for both primary and permanent dentitions

2) The international numbering system (The two digit system) (Fig. 10):

- For *permanent teeth*, the first digit (1-4) is for the quadrant, the second digit is for the tooth (1-8).
- For *deciduous teeth*, the first digit (5-8) is for the quadrant, the second digit is for the tooth (1-5) .



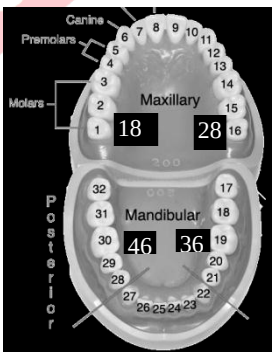


Fig. 10: Two digit system and universal system for both primary and permanent dentitions

3)**The universal numbering system (American numbering system)** (Fig. 10):
The number is always preceded by the sign #

- Permanent teeth (1 – 32)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

#28 is lower right first premolar.

- Deciduous teeth (#d 1-20) or (# A-T)

1	2	3	4	5	6	7	8	9	10	A	B	C	D	E	F	G	H	I	J
20	19	18	17	16	15	14	13	12	11	T	S	R	Q	P	O	N	M	L	K

d# 14 lower left deciduous lateral incisor. #B upper right deciduous first molar.

Macro and micro-anatomy of the tooth

- *Each tooth has three anatomical parts* (Fig. 11):

I.Crown
II.The Neck: *cervical line*
II.Root (s)

- The teeth either **single** rooted or **multi**-rooted.
- The **crown** is formed anatomically from **dentin** that is covered with **enamel** while the **root** is formed anatomically from **dentin** that is covered with **cementum**. The **pulp** is the only soft tissue in the tooth.

Fig. 11: Macro-anatomy of the tooth.

Socket and crypt

Socket is the bone of the jaw that contains the roots of erupted teeth, while the developing tooth present in a bony space that is called **crypt** (Fig. 12).

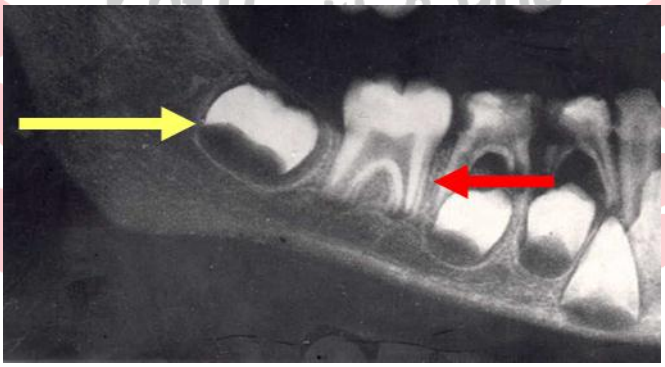
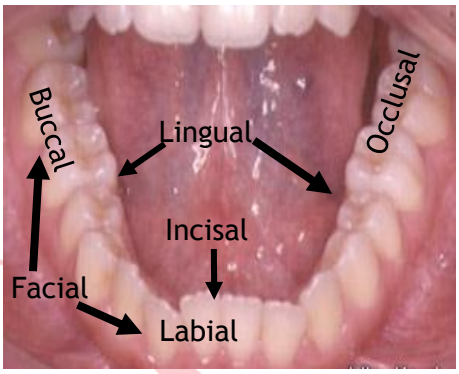


Fig. 12: Socket (red arrow) crypt (yellow arrow).

Surfaces of the teeth

Each tooth has five surfaces like a box with 4 sides and a roof (Fig.13).

- **Facial** surface: the external tooth surface, it is **labial** for anterior teeth and **buccal** for posterior teeth.
- **Lingual** (for all teeth) or **palatal** (for upper teeth) surface: the internal tooth surface toward the tongue or the palate.
- **Proximal** surface: the sides of the tooth, it is called **mesial** when directed towards the midline and called **distal** when directed away from the midline.
- **Masticatory** surface: the biting surface is called **incisal** for anterior teeth and the grinding surface is called **occlusal** for posterior teeth.



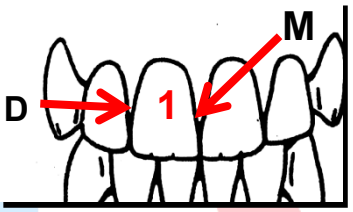


Fig. 13: Surfaces of the teeth.

Division of the tooth surfaces

The crown and the root can be divided vertically and horizontally into thirds to facilitate their description (Fig.14).
Note; the root is divided vertically into halves not thirds as the roots are narrower than the crowns.

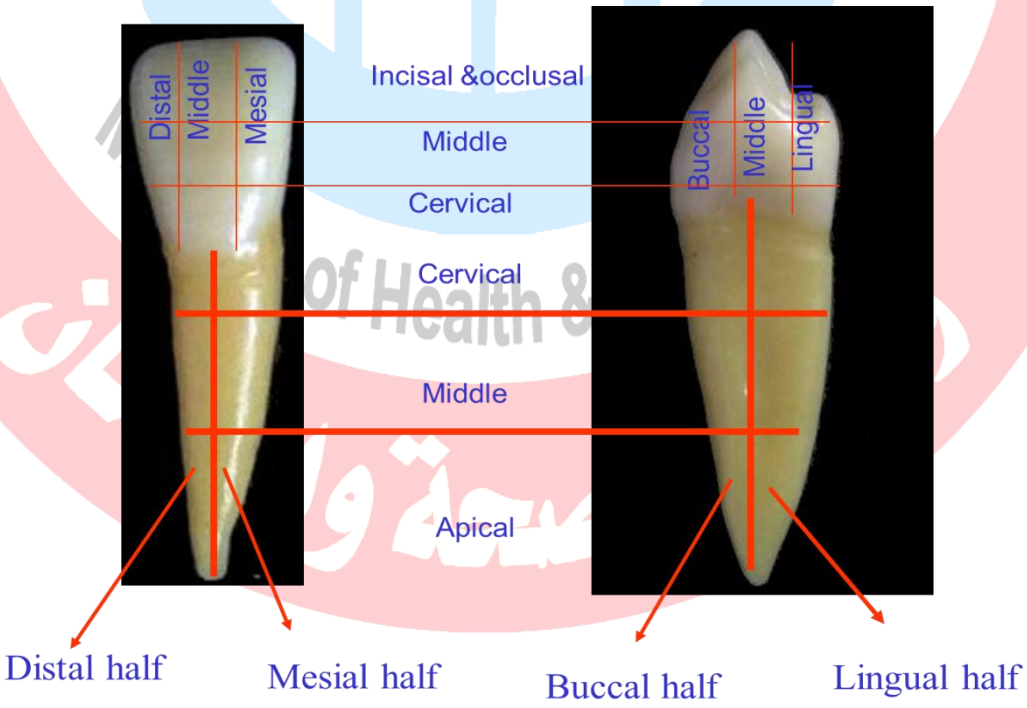


Fig. 14: Division of tooth surfaces.

Anatomical landmarks of the tooth crown

The crown surface of the tooth show different landmarks. These are either elevations or depressions.

A - Crown Elevations: They are either Lobe, Tubercle or Ridge.

- **Lobe:**

It is the primary center of calcification formed during the crown development.
Each tooth is formed of three, four or five lobes.
Note, the pulp has extension which is called horns corresponding to these lobes.

Lobe appeared in the fully formed teeth as **mamelons** in the incisors (Fig. 15 a), **cingulum** in the anterior teeth (Fig. 15 b) and **cusps** in the canine and posterior teeth (Fig. 15 c).

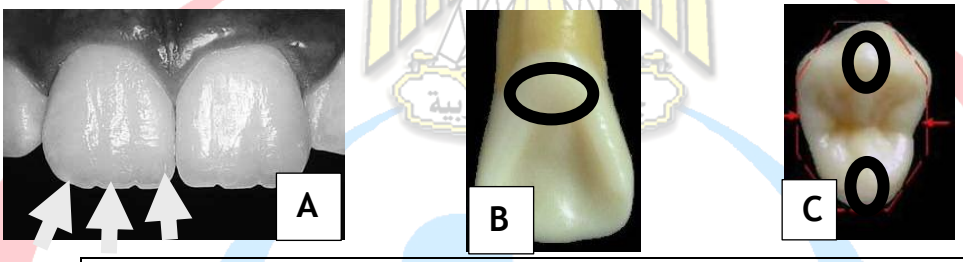


Fig. 15: Mamelons (A), cingulum (B) and Cusps (C).

- **Tubercle**.

It is a *small elevation*. It is produced by excessive formation of enamel only without dentin or pulp horns. It appeared in the upper first permanent molar and the upper second deciduous molar (Fig. 16).

Fig. 16: Tubercle.

- **Ridges**.

It is a *linear elevation* on the different surfaces of the crown.

1-Ridges that could be found on the ***Facial surfaces*** (Fig. 17):

A-***Labial***: in canines or ***Buccal*** in premolars.
B-***Cervical***: in all teeth at the cervical third.

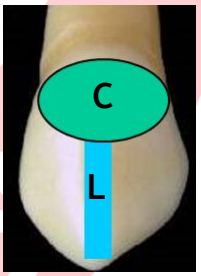


Fig. 17: Cervical (C) and labial (L) ridges.

2-Ridges that could be found on the ***Lingual surfaces*** (Fig. 18):

A- ***Lingual***: in canines.
B- ***Marginal***: in all anterior teeth.
C- ***Incisal*****:** in all anterior teeth.

Fig. 18: Marginal (black arrow), incisal (red arrow) and lingual (L) ridges.

3- Ridges that could be found on the ***Occlusal surfaces*** (Fig. 19):
A- ***Triangular***: for each cusp in all posterior teeth.
B- ***Marginal***: in all posterior teeth and called mesial and distal marginal ridges.
C- ***Transverse***: in lower premolars.
D- ***Oblique***: in upper molars.

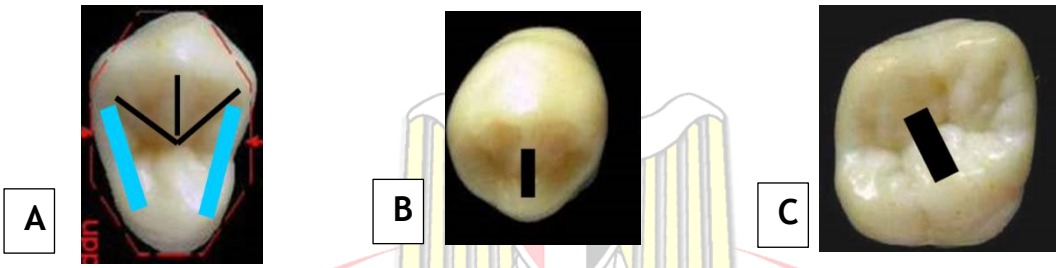


Fig. 19: Upper premolar showing **t**riangular ridge for each cusp and marginal ridges (A), lower premolar showing same ridges as (A) in addition to transverse ridge (B) and upper 6 showing same ridges as (A) in addition to oblique ridge (C).

B- Crown depressions: They are either Linear or circumscribed.

1-Linear depressions:

A-**Developmental grooves** (Fig. 20)**:** They present where **lobes united** together. They could be found on the *occlusal*, *buccal* and *lingual* surfaces of **posterior teeth**. On the *labial* surfaces of the anterior teeth, these grooves are shallow so termed **developmental depressions**.

Fig. 20: Developmental grooves on the occlusal surface of lower 6 (A) and on the buccal surface of upper 6 (B). Developmental depressions on the labial surface of upper incisors (C).

B-**Supplemental grooves** (Fig. 21): They do not represent union of lobes. They could be found in second and third molars as well as second premolars.

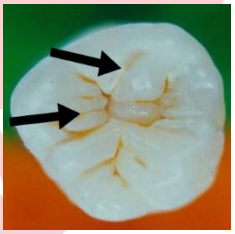


Fig. 21: Supplemental grooves on the occlusal surface of upper 8

C-**Fissure** (Fig. 22): They represent linear incomplete union of enamel present at the depth of developmental grooves.

Fig. 22: Fissure at the depth of the developmental groove.

Note: The depression between cusps of a tooth is called ***sulcus.*** It appears from **proximal**, **facial** or **lingual** aspects. Developmental grooves present at the depth of these ***sulci*** (Fig. 23).

Fig. 23: **Sulcus** appeared **lingually** (A) and **proximally** (B)

2-Circumscribed depressions:

A-**Fossa** (Fig. 24.): They are either ***Lingual*** on the lingual surfaces of anterior teeth, ***Central*** on the occlusal surfaces of posterior teeth or ***Mesial*** and ***Distal*** triangular fossae on the occlusal surfaces of posterior teeth.

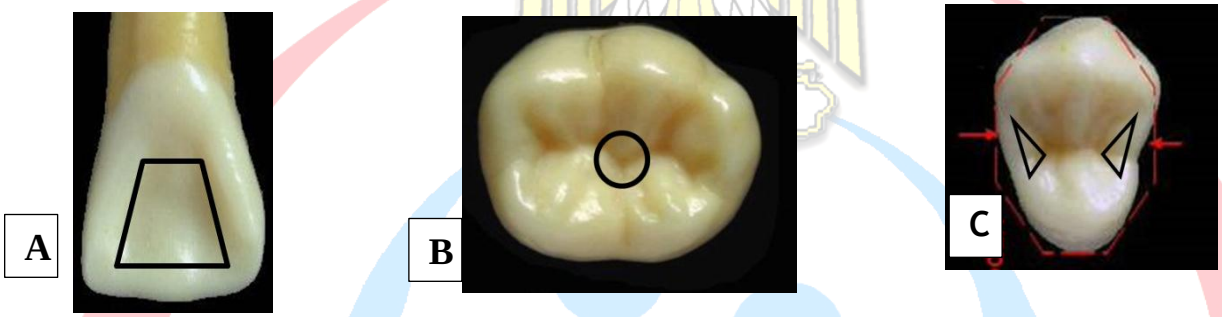


Fig. 24: **Lingual** fossa on the lingual surfaces of anterior teeth (A), **central** fossa on the occlusal surfaces of posterior teeth (B), **Mesial** and **Distal** triangular fossae on the occlusal surfaces of posterior teeth (C).

B-**Pits** (Fig. 25.): They are either ***True*** or ***False*** (faulty).

True pits; present at the bottom of **central**, **mesial** and **distal** triangular fossae. They could be found at the end of the **buccal** and **palatal** grooves in molars.

Faulty pits; usually **develop** as a result of incomplete formation of ***enamel***

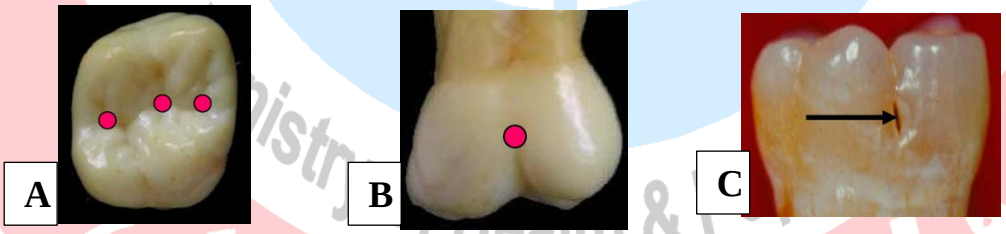


Fig. 25: **Central, mesial** and **distal** pits on the occlusal surfaces of posterior teeth (A), **palatal** pit on the palatal surfaces of molars (B), **Faulty** pit (C).

Chapter 2
Permanent anterior teeth

Objectives

- Identify permanent anterior teeth.
- Differentiate between upper and lower permanent anterior teeth.
- State the importance of physiologic tooth form in protecting the periodontium.

Anterior teeth

They are divided into **Incisors** & **Canines**.

Incisors

-There are four maxillary incisors & four mandibular incisors.
-Two central incisors contact each other (mesially) & with the lateral incisors distally.
-Two lateral incisors contact with the centrals mesially & with the canines distally (Fig. 26).
-All anterior teeth are formed of four lobes (3 labially & 1 lingually).

Fig. 26: Anterior teeth.

N.B: The minimum number of lobes in normal teeth is three, however the peg shaped upper lateral incisor has 2 lobes (Fig. 27).

Fig. 27: Peg shaped tooth.

Note*: When describe a tooth, one have to speak about:*
1- Geometric outline of the crown for each aspect.
2- Outlines of the crown & root (concave, convex or straight)
3- Surface anatomy of the crown & the root (anatomical landmarks)

Upper Central Incisor

-Maxillary central incisor is the first tooth from the midline, -it is the widest of all incisors & its crown is the longest of all dentition (Fig. 28).

Fig. 28: Widest teeth.

1- **Labial and lingual aspects** :
a) **<u>Geometric Outline</u>** (Fig. 29):
-They both have a trapezoidal outline with the smallest of the uneven sides is directed cervically.

Fig. 29: Trapezoidal outline.

-The **importance** of this trapezoid is to provide proper contact area. This contact area **prevents** food impaction, **distributes** the masticatory forces and **stabilizes** the dental arch. Trapezoidal shape also **provides** support of the opposing teeth.

b) **Outlines of the crown:**

-*Mesial* outline is convex with *sharp mesioincisal angle.*

-*Distal* outline is more convex with rounded distoincisal angle.

-Mesial contact area is at the incisal third while the distal contact area is at the junction between the middle & incisal thirds

-*Incisal* outline (edge) is straight and may have mamelons

-*Cervical* outline is convex root-wise

Outline of the root:

-The mesial & distal outlines are tapered towards a **blunt** apex which is **centralized** on the long access of the root.

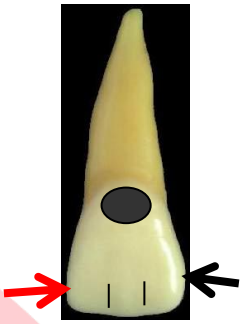


Fig. 30: Surface anatomy of the labial surface and contact areas (arrows).

c) **Surface anatomy of the crown & root** :

Labial aspect (Fig. 30):

Elevations: The crown surface is smooth & convex with the maximum convexity is at the cervical 1/3 (cervical ridge).

Depressions: Shallow developmental grooves could be seen separating the mamelons.

The root surface is smooth and convex.

Lingual aspect (Fig. 31):

Elevations :

-Marginal ridges (mesial and distal).

-Cingulum (a smooth large convexity which represents the lingual lobe)

-Incisal ridge.

Depressions :

Lingual fossa (trabezoidal in shape).

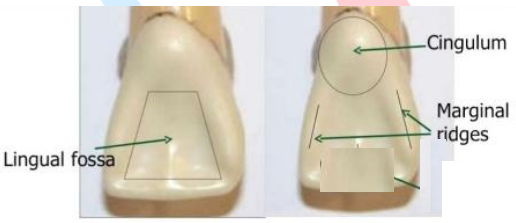


Fig. 31: Surface anatomy of the lingual surface.

Note: The lingual surface of all teeth is smaller in size than the facial surface due to the lingual convergency. This convergence of teeth is to accommodate the larger arch size facially than lingually.

2- **Proximal aspects** (*mesially & distally*):

a) Geometric outline (Fig. 32):

-They both have triangular outline with the base cervically and apex incisally.

-The **importance** of this triangular shape is to **facilitate** food cutting, provide wide base so **increase strength** of the tooth and **allow** the tooth surfaces to be **self-cleansing**.

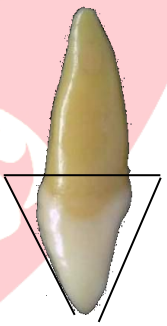


Fig. 32: Triangular outline.

b) Outlines of the crown:

-*Labial* outline is convex with maximum convexity at the cervical 1/3 which represent the cervical ridge.

-*Lingual* outline is convex incisally (incisal ridge), concave at the middle (lingual fossa) and convex cervically (cingulum).

-Cervical outline curves incisally

 # Outlines of the root:

The outlines taper from the cervical line to a **blunt rounded** apex

c) <u>Surface anatomy of the crown & root</u> (Fig. 33):

The crown has smooth convex proximal surfaces

 # Mesial surface:

-The contact area is near the mesio-incisal angle.

-The cervical line is curved incisally.

 # Distal surface:

-The contact area is at the junction between the incisal and middle thirds.

-The cervical line is shallower than mesially.

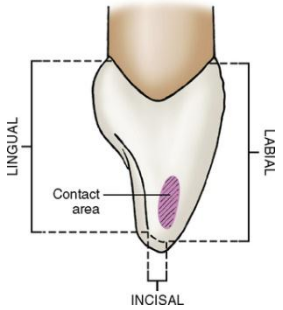


Fig. 33: Surface anatomy of the proximal surfaces.

3-Incisal aspect (Fig. 34):

-The outline is triangular in shape with its base labially & apex lingually.

-The mesiodistal dimension (width) is greater than the labiolingual (thickness).

-The crown is tapered lingually.

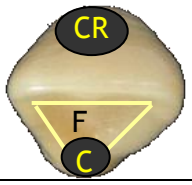


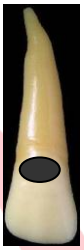
Fig. 34: Surface anatomy of the incisal surface, cervical ridge (CR), cingulum (C) and lingual fossa (F).

N.B: *The elevations & depressions in the crown labially & lingually are shown in this aspect.*

Upper Lateral Incisor

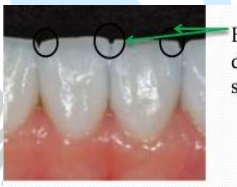
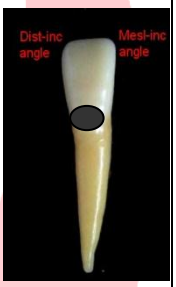
The lateral incisor is smaller in all dimensions than the central incisor (Fig. 35).

Fig. 35: Maxillary incisors.

Maxillary central incisor	Maxillary lateral incisor
Newly erupted tooth has mamelons  **Labial aspect** *crown outline: -**Sharp** mesioincisal angle. -**Rounded** distoincisal angle. -Incisal outline is straight. *Root outline: -The mesial and distal outlines of the root tapers to a **blunt** apex. -The apex is **centralized** on the long axis *The labial surface is convex or slightly flat .with labial developmental grooves (DG). **Lingual aspect:** (see central incisor) **Mesial aspect:**  -The crown is long and thick. -The mesial surface is flat. -The contact area is at the incisal third near the MI angle. **Distal aspect:** The contact area is at the junction of incisal and middle third **Incisal aspect:**  -Wide mesiodistally. -Labial and lingual outlines are flat and broad.	The mamelons are less pronounced. The peg shaped lateral is a pointed form that could exist having 2 lobes 1labial and 1lingual. **Labial aspect**  -**Rounded** MI angle. -**More rounded** DI angle. -Incisal outline is rounded. -Contact areas are more cervical. -The mesial and distal outline of the root tapers to a **pointed** apex. -The apex is directed **distally**. The labial surface is more convex, the DGs are less prominent. **Lingual aspect:**  Similar to upper central except; -Lingual fossa is more concave. -The lingual pit could be found at the depth of the fossa. -All elevations are well developed. **Mesial aspect:**  -The crown is shorter and thinner. -The surface is flatter. -The contact area is near or at the junction of incisal and middle third. **Distal aspect:** The contact area is in the center of the crown. **Incisal aspect:**  -Smaller in size -Labial and lingual outline are more rounded. -Lingual pit could be seen.

Mandibular Incisors

-They are smaller than maxillary incisors (Fig. 26).
-The lower central is smaller than the lower lateral, this is the reverse of the maxilla where the upper central is larger than the upper lateral.
-The width (mesiodistal dimension seen labially) is smaller than the thickness (labiolingual dimension seen from the proximal surface)
-The mamelons are worn off soon after eruption.
-The incisal ridges are inclined lingually to the root axis.

Mandibular Central incisor.	**Mandibular Lateral incisor.**
-It is the first Mandibular tooth from the midline. -It is the smallest tooth in the permanent dentition. -It is the most symmetrical tooth in the permanent dentition. **Labial aspect:** a) **<u>Geometric outline of the crown</u>** : Similar to *upper 1* b) **<u>Outline of the crown:</u>** - Mesial and distal outlines are straight tapering evenly to the narrow cervix. -Incisal outline is straight and perpendicular on the tooth long axis. -Mamelons are found on newly erupted teeth -Mesio and disto incisal angles are sharp.  Both mesioincisal and distoincisal angles are sharp -Contact areas mesial and distal are at the same level. #O**utline of the root:** The mesial and distal outline is tapered to a distally curved pointed apex. c)**<u>Surface Anatomy of crown & root:</u>** -Similar to **upper 1** but the elevations and depressions are less developed. **Lingual aspect :** Similar to **upper 1** but the elevations and depressions are less developed.	-it is very similar to the lower central but slightly larger in size. **Labial aspect:** *Same as lower 1* **<u>Outline of the crown:</u>** -The incisal ridge is tilted distally.  -Mesio-incisal angle is sharp while disto-incisal angle is rounded. -Contact area mesially at the incisal third while distally is more cervically. **Outline of the root:** *Same as lower 1*  **<u>Surface Anatomy of crown & root:</u>** *Same as lower 1* **Lingual aspect :** *Same as lower 1* but the cingulum is deviated distally.

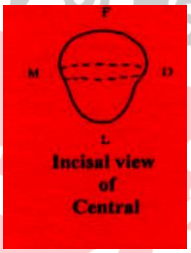
Proximal Aspect:
Geometrical outline and outlines are similar to **upper 1** but *the convexity of the labial and lingual outlines are well developed in the* ***upper teeth*** *than the* ***lower teeth.***

Note: The incisal ridge is lingual to the root axis; this lingual inclination **facilitates proper occlusion**.

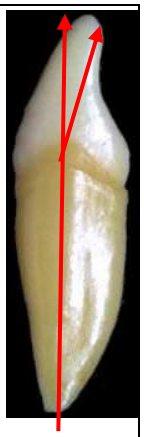
#**Outline of the root**:
The outlines are nearly straight from the cervical line to the middle third then tapered to a pointed apex.
(Remember: the upper incisors taper from the cervical line to a blunt rounded apex)

Surface anatomy of the crown and root:
-The crowns have smooth convex proximal surfaces.
-The **contact areas** mesially and distally are nearly at the same level but still the distal contact area is more cervically.
-The root surface shows a longitudinal **developmental depression** which is deeper **distally** than **mesially**.

Incisal aspect:
-The outline is diamond in shape.
-The labiolingual (thickness) is greater than the mesiodistal dimension.
-the incisal ridge is at right angle to a line bisecting the crown labiolingually



Geometrical outline and outlines:

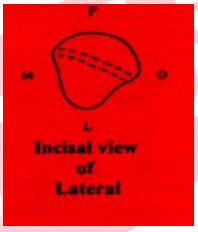


Same outlines as *lower 1* except that;
-The distal aspect is shorter than mesial due to distal tilting of the incisal ridge.

Surface anatomy of the crown and root:
Same as *lower 1*except that the mesial **contact area** is at the incisal third while the distal one is more cervical.

Incisal aspect:

Same as *lower 1*except;
-The incisal ridge and cingulum are tilted distally that allows the tooth to follow the dental arch curvature.



Permanent Canines

The canine is formed of 4 lobes (3 labially & 1 lingually), the middle lobe is well developed providing the **cusp** incisally, **labial** ridge **labially**, & the **lingual** ridge **lingually** (Fig. 36).

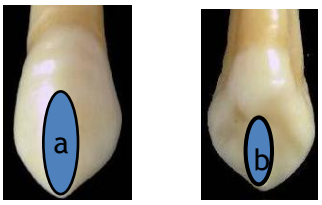


Fig. 36: Maxillary canine with labial ridge (a) and lingual ridge (b).

Maxillary Canines

1-**Labial and lingual aspects:**

a)<u>Geometric outline:</u>

As upper 1

b) <u>Outlines of the crown:</u>

Mesial* outline; Convex till the **contact area (at the junction of **incisal** 1/3 & **middle** 1/3) then continues as concave till the cusp tip.

Distal* outline; Concave till the **contact are (at the middle 1/3) then continues as convex till the cusp tip.

**Cervical* outline; convex root wise.

*The **mesial slope** is shorter than the **distal slope** thus the cusp tip is slightly deviated mesially. The cusp tip is pointed.

#Outlines of the root:

The mesial & distal outlines are tapered to a pointed & distally curved apex.

c)<u>Surface anatomy of the crown</u> (Fig. 37):

 # Labial aspect:

***Elevations**:

Cervical ridge: making the surface convex with the maximum convexity at the cervical 1/3.

Labial ridge: Prominent ridge running from the tip of the cusp toward the cervical margin.

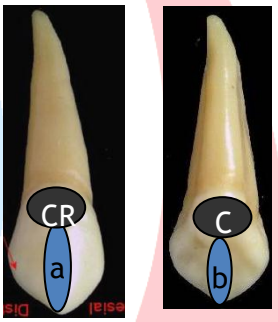


Fig. 37: Maxillary canine with labial ridge (a), cervical ridge (CR), cingulum (C) and lingual ridge (b).

***Depressions**:

Shallow longitudinal depressions run mesial and distal to the labial ridge.

#Lingual aspect:

***Elevations:**

- **Cingulum**, **marginal ridges** and **lingual ridge** that runs from the cusp tip till the cingulum, dividing the lingual fossa into 2fossae (mesial & distal)

#Depressions*:*

- Two lingual fossae.

2-Proximal aspects (Fig. 38)**:**

a) <u>Geometric outline</u>:

Triangular (wedge in shape) with the apex incisally & the base cervically, the cusp tip is centralized on the long axis or inclined labially.

Fig. 38: Proximal surface of upper canine.

b)<u>Outlines of the crown:</u>

* *Labial* outline is convex with the maximum convexity at the cervical 1/3, representing the cervical ridge.

Lingual* outline is convex with max convexity at the cervical 1/3 representing the cingulum, then straight line dur to the presence of the **lingual ridge, then convex again

representing the incisal ridge.

**Cervical* line is curved incisally, however the curvature is less on the distal aspect.

#Outlines of the root:

They are tapered from the cervical line to a blunt pointed apex, its apical 1/3 may be curved labialy.

c)Surface anatomy of the crown & root:

- The crown surface is convex and smooth, except the area cervical to the contact shows flattening on mesial surface or slight concavity on distal surface.
- The root surface is broad with longitudinal depression which is shallower mesially than distally.

3- Incisal Aspect (Fig. 39)**:**

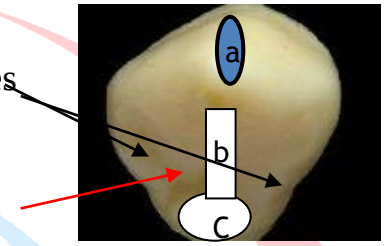


Fig. 39: Lingual ridge (b), cingulum (c) and labial ridge (a).

Geometric outline:

a)Diamond, with the thickness (labio-lingually) greater than the width (mesio-distally).

b) The labial surface is convex, more convex than all other incisors.

c) The cingulum on the lingual surface shows a small arc.

N.B the elevations & depressions in the labial & lingual surfaces appear in this aspect

Mandibular Canines

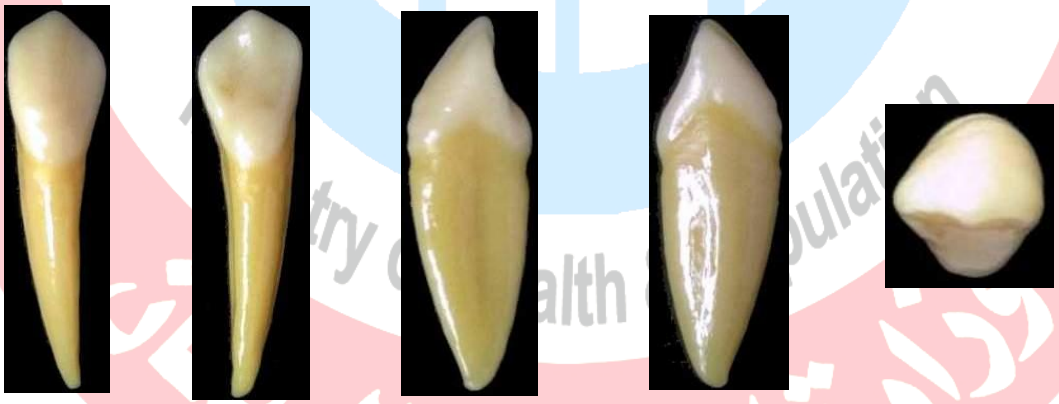


Fig. 40: Mandibular canine.

The mandibular canines are almost similar to maxillary canines in all aspects (Fig. 40) *except the following points;*

Labial & Lingual aspects:

- Mesial outline is straight.
- Both contact areas are more incisally so the crown appears longer & thinner than 3.
- Cusp tip is less pointed.
- The lingual ridge is restricted to the incisal 1/3.

- There is only one lingual fossa.
- The elevations of the lower canine are not well developed as the upper.

Proximal aspect:

- The cusp tip of the lower canine may be inclined **lingually**.
- The lingual outline is concave in the middle rather than straight due to short lingual ridge.
- The outlines of the root are nearly straight from the cervical line to the middle third then tapered to a more pointed apex
- The depression on the root surface maybe so deep causing bifurcation to the root. The bifurcation maybe apical or extend up to the cervical 1/3 (Fig. 41).

Fig. 41: Mandibular canines with deep developmental depression on the root causing apical bifurcation.

Chapter 3
Premolars

Objectives

- Identify premolars.
- Differentiate between upper and lower premolars.
- State the importance of physiologic tooth form in protecting the periodontium.

Premolars

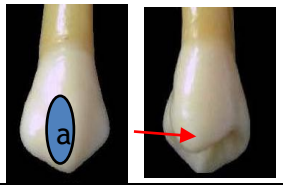


Fig. 42: Maxillary first premolar with buccal ridge (a) and lingual cusp (arrow).

*They are 2 in numbers in each quadrant.
*They concerned with tearing and grinding.
*They have one buccal cusp and one or two lingual cusps.
*They have one root except upper premolars may have 2 roots.
*They are formed of 4 lobes (3 buccally & 1 lingually), the **buccal** middle lobe is well developed to give the **buccal cusp occlusally** and the **buccal** ridge **buccally**. The **lingual** lobe developed to give **cusp lingually** (Fig. 42). Sometimes lower 5 has 3 cusps thus it is formed of 5 lobes (3 buccally and 2 lingually in the form of 2 lingual cusps.

Maxillary first premolar

1-**Buccal aspects** (Fig. 43):

a)<u>Geometric outline:</u>

As upper 1

b) <u>Outlines of the crown:</u>

* *Mesial and distal* outlines and slopes are slightly concave.
**Cervical* outline; convex root wise.
***Contact area** mesially is at the middle third (which is exception from other permanent teeth). **Distal** contact area is positioned occlusally.

Note; the mesial slope is longer than the distal one (which is exception from other permanent teeth).

#Outlines of the root:

The mesial & distal outlines are tapered to a pointed & distally curved apex. If **two roots**, the buccal root hides the lingual root as it's shorter and narrower than the buccal one.

Fig. 43: Buccal (a) and cervical ridge (CR).

c)<u>Surface anatomy of the crown</u>:

***Elevations and depressions**:

They are similar to upper 3 but less prominent. The cusp tip is less prominent compared with that of upper 3

2-Lingual aspect (Fig. 44):

Fig. 44: Lingual aspect of upper 4.

*__Mesial__ and __distal__ outlines are convex.
*The distal slope of the lingual cusp is **longer** than the mesial one.
*The **lingual** cusp is shorter by 1 mm.
*The surface is convex with the maximum convexity at the middle third. There is also **lingual convergence**.

3-Proximal aspects (Fig. 45)**:**

a) <u>Geometric outline</u>:

Trapezoidal in shape with the smallest of the uneven side is directed occlusally (the reverse of the facial and lingual trapezoid). The significance of this trabezoidal is the same as triangle of anterior teeth.

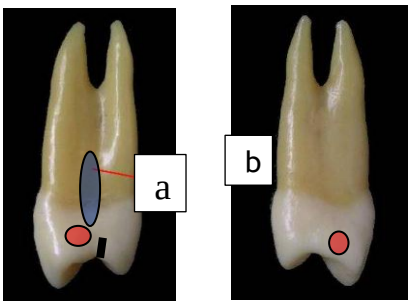


Fig. 45: Mesial (a) and distal (b) surfaces of upper first premolar.

b)<u>Outlines of the crown:</u>

* ***Buccal*** outline is convex with the maximum convexity at the cervical 1/3, representing the cervical ridge.

*__Lingual__ outline is convex with max convexity at the middle 1/3.

*__Cervical__ line is curved occlusally however the curvature is less on the distal aspect.

*__Occlusal__ outline is formed of two cusps. The buccal cusp is longer by 1 mm. The marginal ridges position differs mesially than distally as following;

Mesial aspect	Distal aspect
Mesial marginal ridge present at the junction of Middle &Occlusal thirds.	**Distal marginal ridge** more occlusal.

#Outlines of the root:

In case of one root (Fig. 46); the B and L outlines tapered to a blunt apex on the center of the crown.

The **surface** is smooth and convex except shallow depression in the center that is deeper **mesially** than **distally**.

In case of two roots (80%); there will be root trunk about half the root length **mesially** while the root trunk is longer **distally**.

The **surface** is smooth and convex except shallow depression on the root trunk.

Fig. 46: single rooted upper first premolar..

c)<u>Surface anatomy of the crown:</u>

The surface anatomy differs mesially than distally;

Mesial aspect	Distal aspect
***Contact area:** At the middle third (Occluso-cervical dimension) and slightly buccal to midline (Bucco-lingual dimension). ***Mesial Marginal developmental groove** is crossing mesial marginal ridge and located lingual to the contact area. * **Mesial Developmental depression** in the crown and continue with that on the root or root trunk (**canine fossa**).	*Occlusally positioned and more buccally. *Smooth and convex surface except for a small flat area cervical to contact area.

4- Occlusal Aspect (Fig. 47)**:**

Fig. 47: Occlusal aspect of upper first premolar.

***Geometric outline** is hexagonal with 2 equal buccal sides (MB, DB), mesial side is shorter than distal side and mesio-lingual side is shorter than the disto-lingual side.
-The thickness is greater than width.
-The crown is wider buccally than lingually (due to lingual convergence).

***Elevations:**
-Buccal and lingual triangular ridges.
-Mesial and distal marginal ridges.

***Depressions:**
-Central developmental groove.
-Mesial and distal triangular fossae.
-M**esial** marginal developmental groove.

Maxillary second premolar

It is similar to upper first premolar except;

Upper first premolar	Upper second premolar
Buccal aspect: - Buccal cusp is long and pointed. -Longer mesial slope than distal one. -Mesial contact area in the middle third while distal one is more occlusal. -Prominent buccal ridge. -Short root.	**Buccal aspect:** -Buccal cusp is short and blunt. -Shorter mesial slope than distal one. -Mesial contact area in the occlusal third while distal one is more cervical. -Less prominent buccal ridge. -Longer root.
Lingual aspect: -The lingual cusp is shorter by 1 mm than the buccal cusp. - 80%, 2 roots.	**Lingual aspect:** - The lingual and buccal cusps are nearly of same height. -Rare to have 2 roots (20%).
Mesial aspect: -Buccal cusp is longer than lingual cusp by 1mm. -The occlusal table is wide. -Mesial marginal developmental groove and canine fossa. -MMR at the junction of M1/3 &O1/3 -**Contact area;** at the middle third (OC dimension) and slightly buccal to midline (BL dimension). - Root trunk about half the root length.	**Mesial aspect:** - The lingual and buccal cusps are nearly of same height. - The occlusal table is narrow. - The crown surface is smooth and convex. -MMR positioned more occlusal. - **Contact area;** at the occlusal third (OC dimension) and slightly buccal to midline (BL dimension). -Root has shallow developmental depression.
Distal aspect: -Distal marginal ridge is more occlusal than mesial one. -**Contact area;** occlusally positioned and more buccally than mesial one. -Root trunk is long as the bifurcation is near apical 1/3.	**Distal aspect:** - Distal marginal ridge is more cervical than mesial one. -**Contact area;** cervically positioned and more buccally than mesial one. - One root and if 2 the bifurcation will be more apically.
Occlusal aspect: -It is hexagonal. -**Thin** marginal ridges as the central groove is **long** and extend **mesially** giving the **mesial marginal groove.**	**Occlusal aspect:** - It is oval. -**Thicker** marginal ridges as the central groove is **short**. -Supplemental grooves could be found.

Mandibular premolars

Lower first premolar	Lower second premolar
Buccal aspect: **Geometric outline:** As upper 1 **Outlines and surface anatomy of the crown:** -Mesial and distal outlines and slopes are concave. -Shorter mesial slope than distal one. -Buccal cusp is long and pointed. -Mesial **contact area** at the junction of occlusal and middle thirds while distally it is cervically positioned. -Prominent buccal and cervical ridges. **Outlines and surface of the root:** -The mesial and distal outline of the root tapered to a pointed **apex** that curved distally. - The surface of the root is convex and smooth.	 **Buccal aspect:** **Geometric outline:** As upper 1 **Outlines of the crown:** The same as lower 4 except; -Buccal cusp is short and blunt. -Less prominent buccal ridge.
Lingual aspect: -The lingual cusp is short reaching 2/3 the crown length and has a pointed tip. - The lingual surface is convex with maximum convixty at the **middle** 1/3. -Mesio-lingual developmental groove is at the mesio-lingual line angle. -Severe lingual convergence.	 **Lingual aspect:** Lower 5 may have **2 cusps**; one buccal and one lingual Or have **3 cusps**; one cusp buccally and two cusps lingually (mesio-lingual and disto-lingual) -If lower 5 has two cusps; the lingual and buccal cusps are nearly of the same height. -If has three cusps; the **mesio-lingual** cusp is longer and larger than the **disto-lingual** cusp. Both lingual cusps are shorter than the buccal. - The lingual surface is convex with maximum convixty at the **occlusal** 1/3. -No Mesio-lingual developmental groove. -If three cusps; there will be lingual groove between the 2 lingual cusps. -Slight lingual convergence.

Mesial aspect:

Geometric outline:

-Rhomboidal with narrow occlusal table.

It is not trapezoidal as upper premolars due to **lingual inclination** of the crown.

-The significance of this rhomboid is the same as the triangle of the anterior as well as giving proper occlusion.

Outlines of the crown:

* ***Buccal*** outline is convex with the maximum convexity at the cervical 1/3, representing the cervical ridge.

*__Lingual__ outline is convex with max convexity at the middle 1/3.

*__Cervical__ line is curved occlusally however the curvature is less on the distal aspect.

*__Occlusal__ outline is formed of two cusps. The lingual cusp is short reaching 2/3 the crown length.

-The **marginal ridges** position and direction differ mesially than distally;

Mesial aspect	Distal aspect
-Mesial MR is inclined parallel to buccal cusp ridge.	-Distal MR is straight.
-Present at the junction of the middle and occlusal thirds.	-Present more occlusal.

Outlines and surface of the root:

-B & L outlines are nearly straight cervically then tapered apically to a blunt apex.

-The **surface** of the root is convex **mesially** but has developmental groove **distally**.

Surface anatomy of the crown:

The surface anatomy differs mesially than distally;

Mesial aspect	Distal aspect
***Contact area:** At the junction of the middle and occlusal thirds and slightly buccal to midline.	*More cervical. *Smooth and convex surface except for a small flat area cervical to contact area.
***Mesio-lingual developmental groove**	

Mesial aspect:

Geometric outline:

-The same as lower 4 but the lingual inclination less prominent

Outlines of the crown:

The same as lower 4 except;

- The lingual and buccal cusps are nearly of same height.

-If has 3 cusps; the **mesial aspect** shows the buccal and mesio-lingual cusps while the **distal aspect** shows the 3 cusps.

-Both marginal ridges are straight.

Occlusal aspect:

-It is diamond.
-Shows **sever lingual convergence.**
-Elevations:
*Mesial and distal marginal ridges.

*Buccal and lingual triangular ridges.

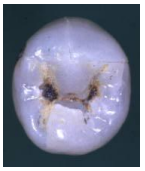
*__Transverse ridge__.

-Depressions:

*Central developmental groove that extends **mesio-lingually** giving the **mesio-lingual groove.**

*Mesial and distal triangular fossae.

Occlusal aspect:



H type

U type

Y type

If two cusp type the occlusal geometric outline is oval with slight lingual convergence.
If three cusp type the occlusal geometric outline is square with slight lingual convergence.
-Elevations:
*Mesial and distal marginal ridges.
*Buccal and lingual triangular ridges **(2 cusp type).** Buccal, mesio-lingual and disto-lingual ridges **(3 cusp type).**
*__Transverse ridge__ in 2 cusp type.

-Depressions:
*Central developmental groove that extends **lingually** separating unequally both the **mesio-lingual** and **disto-lingual cusps** giving the shape of Y (3 cusp type)**.**
*Central developmental groove that takes the shape of **U** or **H** (2 cusp type)**.**
***** Mesial and distal triangular fossae.
***Central fossa (**in 3 cusp type)

-Supplemental grooves could be found.

Chapter 4
Permanent molars

Objectives

- Identify permanent molars.
- Differentiate between upper and lower molars.
- State the importance of physiologic tooth form in protecting the periodontium.

Permanent Molars

- They are three in each quarter (Fig. 48).
- Function: crushing and grinding of the food.
- Multicusped teeth with a wide occlusal surface.
- Upper molars have 3roots while lower molars have 2.
- Occlusal outline: upper; rhomboidal or heart
  lower; hexagonal or rectangular.
- Lower molars' crowns inclined lingually.
- They have no predecessors.

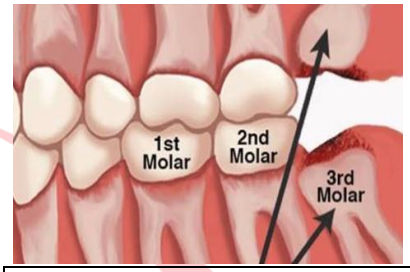


Fig. 48: Maxillary and mandibular permanent molars.

Maxillary first permanent molar

1-**Buccal aspects** (Fig. 49):

a)<u>Geometric outline:</u>

As upper 1

b) <u>Outlines of the crown:</u>

* *Mesial and distal* outlines and slopes are slightly convex except mesial outline is straight.

* **Contact area** mesially is at the junction of the occlusal and middle thirds. **Distal** contact area is positioned at the middle third.

**Cervical* outline; convex root wise.

*Occlusal outline; Mesio-buccal cusp is broad and short.
Disto-buccal cusp is narrow, long and sharp.

The lingual cusps can be seen due to; a-Presence of **distobuccal convergence**.
b-Rhomboidal occlusal outline.

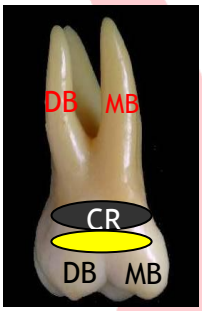


Fig. 49: Facial aspect with cervical ridge (CR) mesio-buccal cusp and root (MB), disto-buccal cusp and root (DB).

#Outlines of the root:

*There is a **root trunk** of **4 millimeters** in length**,** a deep developmental depression extends on this root trunk.

*The three roots appeared from this aspect.

***Mesio-buccal** root is wide and long that shows middle curvature.

***Disto-buccal** root is narrower and shorter than **Mesio-buccal** root and straighter.

*****The **palatal root** is the widest and longest from this aspect so appeared behind the 2 buccal roots.

c)<u>Surface anatomy of the crown</u>:

***Elevations and depressions**:

-The surface is convex with maximum convexity in the cervical third (**cervical ridge**).

-There is slight depression occlusal to the cervical ridge.

-A Buccal developmental groove between the 2 buccal cusps that may terminate by buccal pit.

2-Lingual aspect (Fig. 50):

Fig. 50: Lingual aspect of upper 6.

There is **no** lingual convergence.

Outlines of the crown:

**Mesial outline*: Nearly straight and form right angle with the mesial slope of the ML cusp.

**Distal outline*: Convex and form semicircle with the distal slope of the DL cusp.

***Occlusal outline*: **Mesio-lingual** cusp is the largest and longest cusp (3\5 of the crown width). **Disto-lingual** cusp is spheroidal.

**Cervical outline*: Irregular and slightly convex toward the root.

#Outlines of the root:

3 roots could be seen, the palatal root is the widest root from this aspect. Parts of the buccal roots could be seen behind the lingual one.

Surface anatomy of the crown:

***Elevations and depressions**:

-The surface is convex with maximum convexity in the middle third.

-There is a **Tubercle** of **Carabelli** on **Mesio-lingual** cusp.

-A lingual developmental groove between the 2 lingual cusps.

3-Proximal aspects (Fig. 51)**:**

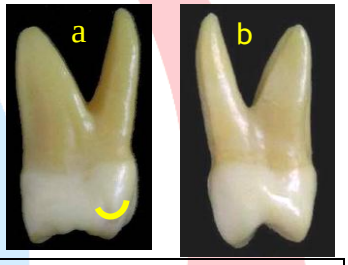


Fig. 51: Mesial (a) and distal (b) surfaces of upper first 6.

a) Geometric outline: Same as upper 4.

b)Outlines of the crown:

* ***Buccal*** outline is convex at the cervical 1/3, representing the cervical ridge, concave at middle 1/3 then convex again.

Lingual* outline is convex with maximum convexity at the middle 1/3. **Tubercle of **Carabelli** appears mesially only.

Cervical line is curved occlusally however the curvature is less on the distal aspect.

**Occlusal* outline differs mesially than distally;

Mesial aspect	Distal aspect
-2 mesial cusps appear. The mesio-lingual is wider. -The **marginal ridge** is relatively long and flat.	-4 cusps appear due to presence of disto-buccal convergence. -The **marginal ridge** is short and curved.

#Outlines of the root:

-The **mesial root trunk** is **3 millimeters** in length while 5 **millimeters distally.**

The mesio-buccal and palatal roots appeared **mesially** while the three roots appeared **distally**. The mesio-buccal root is wider and longer than the disto-buccal one. The palatal root is the longest but the thinnest from this aspect.

c)Surface anatomy of the crown:

-The surface anatomy differs mesially than distally;

Mesial aspect	Distal aspect
* The mesial surface is flat ***Contact area:** At the junction between middle and occlusal 1/3 and buccal to the midline.	***The surface is convex except concave are in the cervical third of the crown. *Cervically positioned and more buccally.

4- Occlusal Aspect (Fig. 52)**:**

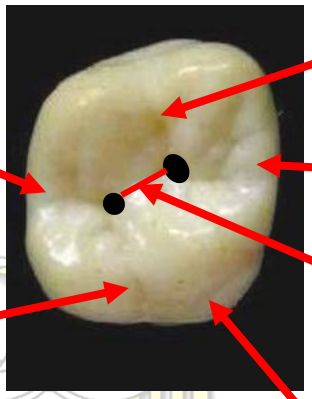


Fig. 52: Occlusal aspect of upper first molar.

***Geometric outline** is rhomboidal

Note: * Disto-buccal convergence.

* Mesio-lingual, disto-buccal angles are obtuse.

*Mesio-buccal, disto-lingual angles are acute.

-The thickness is greater than width.

***Elevations:**

-4cusps with 4 triangular ridges. The cusps arranged from the biggest to the smallest are; Mesio-lingual, Mesio-buccal, disto lingual and the smallest is the disto-buccal cusp.

-Oblique ridge connecting Mesio-lingual and disto-buccal triangular ridges.

-Mesial and distal marginal ridges.

-Tubercle cusp of Carabelli

***Depressions:**

-2 major fossae; central (triangular in shape) and distal (linear in shape).

-2 minor fossae; Mesial and distal triangular fossae.

-Central developmental groove connecting central and mesial triangular fossa.

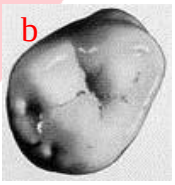
-Buccal developmental groove extends from central fossa to the buccal surface.

-Lingual developmental groove extends from distal fossa to the lingual surface.

-Transverse groove of oblique ridge connects the central and distal fossae.

Maxillary second permanent molar

It is similar to upper first molar except;

Upper first premolar	Upper second premolar
Buccal aspect: -Mesio-buccal cusp is larger but shorter than disto-buccal cusp. -The root trunk is 4mm . -The roots are widely diverging. 	**Buccal aspect:** -Mesio-buccal cusp is larger and longer than disto-buccal cusp. -The root trunk is longer. -The roots are nearly parallel. 
Lingual aspect: - Disto-buccal cusp is the smallest. -Tubercle of Carabelli. 	**Lingual aspect:** -Disto-lingual cusp is the smallest. It may be missed (3 - cusp type). -No tubercle of Carabelli. 
Mesial aspect: - Tubercle of Carabelli. -Outlines of the roots diverge out the outlines of the crown. 	**Mesial aspect:** -No tubercle of Carabelli. -Outlines of the roots within the outlines of the crown. 
Distal aspect: - Distal Convergence. -Convex distal surface. -Distal marginal ridge curved. 	**Distal aspect:** - Simillar to upper 6 
Occlusal aspect: -It is rhomboidal. -Distobuccal convergence. -Tubercle of Carabelli. 	**Occlusal aspect:**   - It is rhomboidal if 4 cusp type (a) or heart shape if 3 cusp type (b). -If 4 cusp type, the acute angles are narrower than those of upper 6. -Lingual convergence. -No tubercle of Carabelli. -Few supplemental grooves.

Maxillary third molar (Fig. 53)

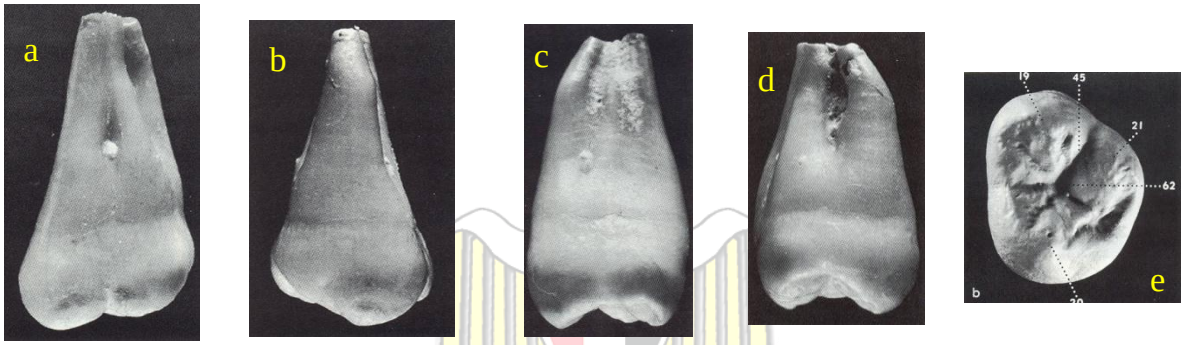


Fig. 53: Different aspects of maxillary third molar, buccal (a), lingual (b), mesial (c), distal (d) and occlusal (e) aspects.

Buccal aspect:

It is similar to upper 7 but the roots are more parallel to each other and may be fused.

Lingual aspect:

It is similar to upper 7, however, most of the third molars have only one large lingual cusp.

Mesial aspect:

It is similar to upper 7 but the roots are more parallel to each other and may be fused.

Distal aspect:

It is similar to upper 7 but there is no contact area.

Occlusal aspect:

-It is similar to upper 7; it may be 3 cusp type which is more common or 4 cusp type.

-It shows multiple supplemental grooves so the occlusal surface has wrinkled appearance.

Note:

Upper third molars show great variations;

-May be large and malformed.

-May be underdeveloped and conical in shape with small tapering root.

-May show accessory cusps and roots.

Mandibular first permanent molar

1-**Buccal aspects** (Fig. 54):

a)<u>Geometric outline:</u>

As upper 1

b) <u>Outlines of the crown:</u>

* *Mesial and distal* outlines and slopes are slightly convex except mesial outline is concave.

* **Contact areas** similar to upper 6

*Occlusal outline; Mesio-buccal cusp is the largest and longest cusp.

Disto-buccal cusp is smaller and shorter.

Distal cusp is the smallest and shortest but the sharpest

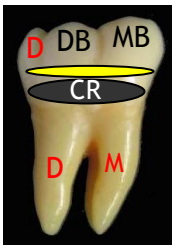


Fig. 54: Facial aspect with cervical ridge (CR) mesio-buccal cusp (MB), disto-buccal cusp (DB), distal cusp and root (D) and mesial root (M).

#Outlines of the root:

*There is a **root trunk** of **3 millimeters** in length**,** a deep developmental depression extends on this root trunk.

***Mesial** root is wide and long that shows middle curvature.

***Distal** root is narrower and shorter than **mesial** root and straighter.

c)<u>Surface anatomy of the crown</u>:

***Elevations and depressions**:

-The surface is convex with maximum convexity in the cervical third (**cervical ridge**).

-There is slight depression occlusal to the cervical ridge.

-Two buccal developmental grooves between the 3 buccal cusps (mesio-buccal and disto-buccal grooves).

2-Lingual aspect (Fig. 55):

There is a lingual convergence.

<u>Outlines of the crown:</u>

**Mesial outline*: Straight while other outlines are convex.

***Occlusal outline*: **Mesio-lingual** and **disto-lingual** cusps which are nearly equal in size and height but the mesiolingual is slightly larger.

**Cervical outline*: Irregular with dipping into the root bifurcation and positioned at occlusal level than that of the buccal surface (this lead to shorter crown length lingually).

Fig. 55: Lingual aspect of lower 6.

#Outlines of the root:

-The 2 roots could be seen.

-The root trunk appears longer on the lingual surface due to:

* The occlusal position of the cervical line

* Lingual conversion.

<u>Surface anatomy of the crown</u>:

***Elevations and depressions**:

-The surface is convex with maximum convexity in the middle third.

-A lingual developmental groove between the 2 lingual cusps.

3-Proximal aspects (Fig. 56)**:**

a) <u>Geometric outline</u>: Same as lower 4.

b)<u>Outlines of the crown:</u>

* ***Buccal*** outline is similar to upper 6.

*****Lingual*** outline is convex with maximum convexity at the middle 1/3.

*****Cervical*** line **slants occlusally from the buccal to the lingual side.**

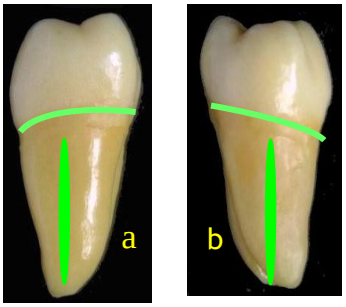


Fig. 56: Mesial (a) and distal (b) surfaces of lower first 6.

*****Occlusal*** outline differs mesially than distally;

Mesial aspect	Distal aspect
-2 mesial cusps appeared. The mesio-buccal is wider but the mesio-lingual is longer and sharper because it is out of occlusion. - The **marginal ridge** is relatively long and flat.	-5 cusps appear due to presence of distal convergence. - The **marginal ridge** is short and curved.

#Outlines of the root:

-Similar to lower premolars.

-Deep depression present on the root surfaces of both **mesial** and **distal** roots.

Note; from the **mesial aspect** only the mesial root could be seen while both roots appeared from the **distal aspect** as the distal root is **shorter** and **narrower** than the mesial root.

c)<u>Surface anatomy of the crown:</u>

-The mesial and distal surfaces are convex except flat area or slightly concave in the cervical third of the crown.

-The mesial and distal surface anatomy differs as follow;

Mesial aspect	Distal aspect
***Contact area:** At the junction between middle and occlusal 1/3 and buccal to the midline.	*Cervically positioned and more buccally.

4- Occlusal Aspect (Fig. 57)**:**

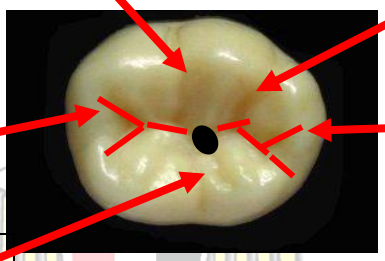


Fig. 57: Occlusal aspect of upper first molar.

***Geometric outline** is hexagonal
- Distal and lingual convergence.
-The width is greater than thickness.

***Elevations:**
-5cusps with 5 triangular ridges. The cusps arranged from the biggest to the smallest are; Mesio-buccal, both lingual cusps, disto-buccal and the smallest is the distal cusp.
-Mesial and distal marginal ridges.

***Depressions:**
-Major central fossa.
-2 minor fossae; Mesial and distal triangular fossae.
-Central developmental groove which is zigzag in shape.
-Mesio-buccal developmental groove (between Mesio-buccal and disto-buccal cusps).
-Disto-buccal developmental groove (between disto-buccal and distal cusps).
-Lingual developmental groove (between the two lingual cusps).

Mandibular second permanent molar

It is similar to lower first molar except;

Lower first premolar	Lower second premolar
Buccal aspect: -Three cusps could be seen; mesio-buccal, disto-buccal and distal. -Two developmental grooves; mesio-buccal and disto-buccal. -The roots are widely diverging. 	**Buccal aspect:** -Two buccal cusps could be seen; mesio-buccal and disto-buccal. -One buccal developmental groove may end with a pit. -The roots are nearly parallel. 
Lingual aspect: - As described before. 	**Lingual aspect:** -Similar to lower 6 but there is no distal cusp.
Mesial aspect: - As described before. 	**Mesial aspect:** - Similar to lower 6 
Distal aspect: - As described before. 	**Distal aspect:** - Simillar to lower 6 but 4 cusps could be seen. 
Occlusal aspect: - As described before. 	**Occlusal aspect:** It is similar to lower 6 except; -Geometric outline is rectangular. -4 cusps with 4 triangular ridges. -One buccal developmental groove. -The central, lingual and buccal developmental grooves form cross shape. -Few supplemental grooves. 

Mandibular third molar (Fig. 58)

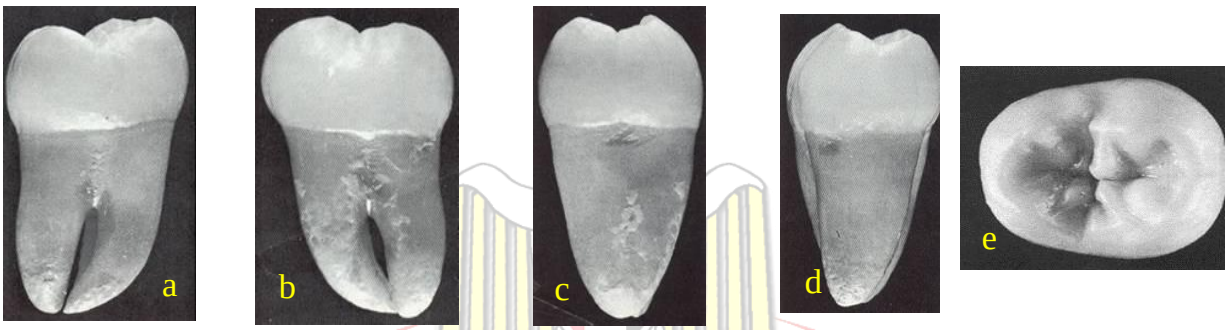


Fig. 58: Different aspects of mandibular third molar, buccal (a), lingual (b), mesial (c), distal (d) and occlusal (e) aspects.

Buccal aspect:

It is similar to lower 6 (has distal cusp) or lower 7 but the roots are more parallel to each other and may be fused.

Lingual aspect:

It is similar to lower 6 (has distal cusp) or lower 7 but the roots are more parallel to each other and may be fused.

Mesial aspect:

It is similar to lower 6 or 7 but the occlusal table is narrower.

Distal aspect:

It is similar to lower 6 or 7 but there is no contact area.

Occlusal aspect:

-It is similar to lower 6 or 7.

-It shows multiple supplemental grooves so the occlusal surface has wrinkled appearance.

Note:

Lower third molars show great variations;

-May be large and malformed.

-May be underdeveloped and conical in shape with small tapering root.

-May show accessory cusps and roots.

Chapter 5
Deciduous teeth

Objectives

- Identify deciduous teeth.
- Differentiate between permanent and deciduous teeth.

Deciduous teeth

- Deciduous teeth are that teeth which function during *childhood* and then they shed and are replaced by permanent teeth (Fig. 59).
- The word deciduous comes from a Latin word meaning to *fall off*. Deciduous teeth are fall off or shed like leaves from a deciduous tree.

Fig. 59: Shedding of deciduous tooth that is replaced by permanent one.

- These teeth *emerge* in children between the ages of 6 months and 2 years. *At the age of 6 years*, these teeth are gradually replaced by the teeth of the permanent dentition. The last tooth to shed will be at 12 years.
- There are *20 teeth* in the deciduous dentition; 10 maxillary and 10 mandibular teeth (Fig. 60).

A) Central incisor.
B) Lateral incisor
C) Canine
D) First molar
E) Second molar

(There are no premolars)

* Common nicknames for deciduous teeth are :
"Primary" , "milk" , "baby" , "temporary"

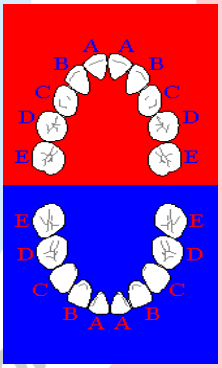


Fig. 60: 20 deciduous teeth.

- They are **important** as they perform great role in;
*Mastication, appearance and pronounciation development.
- They play also very important **role** during the childhood as they help *proper alignment*, *spacing*, and *occlusion of the permanent dentition.*
- When deciduous teeth are *lost prematurely*, this can cause destructive results and should be avoided by construction of **space maintainer** (Fig. 61).

Fig. 61: Space maintainer to keep space for lower 4.

Differences between deciduous and permanent teeth.

A-General differences (Fig. 62):

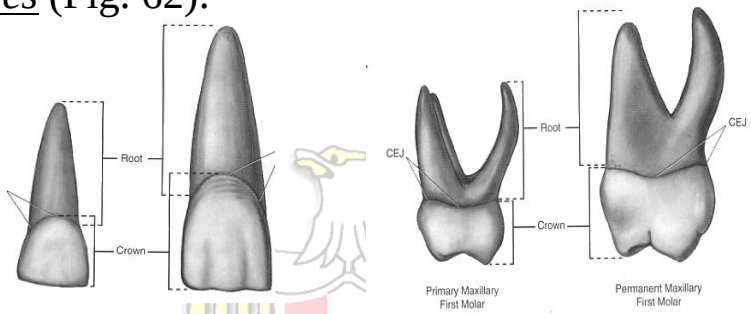
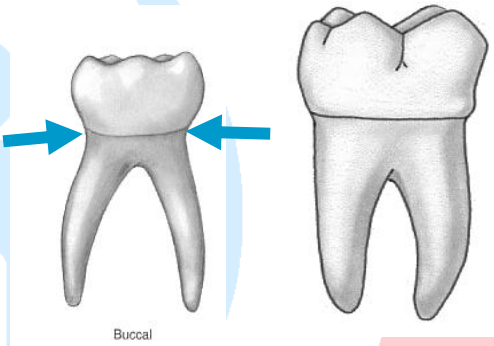


Fig. 62: General differences between deciduous and permanent dentitions. No obvious mamelons in the deciduous incisor.

1-Deciduous teeth are smaller and whiter than permanent teeth.
2- Deciduous teeth have short crown as well as crown root ratio.
3- Deciduous teeth have constricted neck so the crowns appeared bulbous in shape (Fig. 63).

Fig. 63: Constricted neck of the deciduous molar compared with permanent one. Shallow occlusal surface and shallow grooves in the deciduous molar.



*B-Differences related to **anterior teeth**:*

1- Deciduous anterior teeth have no obvious mamelons on their incisal edges as well as no obvious depression between lobes so the labial surface appeared smooth and convex (Fig. 62).
2-On the other hand, anterior deciduous tooth has prominent cingulum and cervical ridge that emphasize the bulbous shape of anterior deciduous teeth (Fig.64).
3-Lower deciduous incisors have no lingual inclination.
4-Upper deciduous canine has longer mesial slope than distal one.

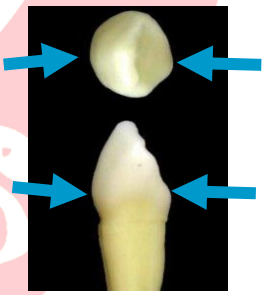


Fig. 64: Deciduous tooth with prominent cingulum and cervical ridge.

*C-Differences related to **posterior teeth*** (Fig. 63):

1- The occlusal surfaces are *shallow*, the cusps are short, the ridges are not pronounced, and the grooves are not deep.
2- The buccal cusps are *not pointed*, their cusp slopes meet at a very wide obtuse angle.
3- There are *few grooves* or depressions in all surfaces of the crowns.

*D-Differences related to **the roots*** (Fig. 65)*:*
1-Deciduous molars have no or very short *root trunk*.
2- Deciduous molars have thin roots.
3- The roots of deciduous molars are *widely divergent* to allow a space for the developing permanent successors.

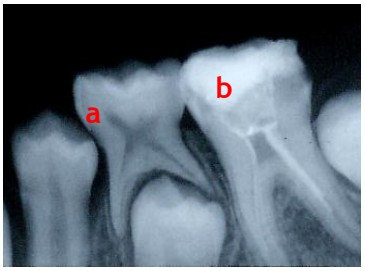


Fig. 65: Widely divergent roots of deciduous molar (a), prominent root tunk and long roots of distally positioned permanent tooth (first permanent molar) (b).

Deciduous anterior teeth

They are similar to permanent anterior teeth except the previously mentioned differences.

Deciduous molars

-There are 2 molars in each quadrant (first and second deciduous molar).
-Each second deciduous molar either upper or lower is similar to its distally positioned permanent tooth (upper or lower first permanent molars respectively), except for the previously mentioned differences.

Maxillary first deciduous molar

-It is the predecessor for the maxillary first premolar.
-It is completely different from the permanent maxillary first molar. Yet, it more closely resembles the maxillary first premolar.
-This tooth may have one of two types:
*Four-cusp type; has two buccal and two lingual cusps
*Three- cusp type; has two buccal cusps and one lingual cusp.

1-Buccal aspects (Fig. 66):

a)Geometric outline:

As upper 1

b) Outlines of the crown:

*Occlusal outline; ***scalloped*** with no definite cusp ridge form.
*There is a ***large*** mesiobuccal cusp and a ***small*** distobuccal cusp.
*The mesial marginal ridge is prominent so it can be seen from this aspect.
Cervical* outline; convex towards the root with the crest of curvature is present mesially to outline ***the most bulging* part of the cervical ridge which is called mesiobuccal cervical ridge.
*There is marked ***constriction*** at the crown cervically.

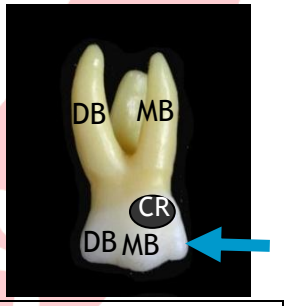


Fig. 66: Facial aspect of upper first deciduous molar with mesio-buccal cervical ridge (CR) mesio-buccal cusp and root (MB), disto-buccal cusp and root (DB) mesial marginal ridge (arrow).

#Outlines of the root:

*The three roots (MB, DB & L) are thin and widely divergent and there is no root trunk.

c)Surface anatomy of the crown:

***Elevations and depressions**:

-There is no buccal groove on the buccal surface but a notch.

-There is a ***prominent cervical ridge*** with more prominence on the mesial half of the buccal surface.

2-Lingual aspect (Fig. 67):

- crown is ***narrower*** due to the lingual convergence and its surface is very convex.

*In the ***four-cusp type***; the distolingual cusp is poorly defined, while in ***three-cusp type*** the distolingual is completely missed.

*The lingual root is the ***largest*** of them

Fig. 67: Lingual aspect of upper D.

3-Proximal aspects (Fig. 68)**:**

a) Geometric outline: Same as upper 4.

b)Outlines of the crown:

* ***Buccal*** outline is ***very convex*** cervically representing the prominent mesiobuccal cervical ridge then it becomes straight from the ridge to the occlusal margin.

*****Lingual*** outline is more gradually convex in the cervical and middle thirds and straight in the occlusal third.

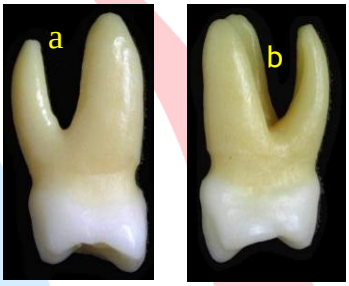


Fig. 68: Mesial (a) and distal (b) surfaces of upper D.

*****Cervical*** line is curved occlusally however the curvature is less on the distal aspect.

*****Occlusal*** outline differs mesially than distally;

Mesial aspect	Distal aspect
-2 mesial cusps appeared. The mesio-lingual is wider. -The **marginal ridge** is relatively long and wide and may be crossed by groove that extended from the occlusal surface.	-In case of 4 cusp type, the disto-lingual is poorly developed and shorter than the distobuccal cusp. -The **marginal ridge** is short and curved.

#Outlines of the root:

-There is a short root trunk, the mesiobuccal root appeared, which is ***wide*** enough to hide the distobuccal root from the **mesial** aspect, and palatal root. **Distally** the three roots could be seen.

4-Occlusal Aspect (Fig. 69 & 70)**:**

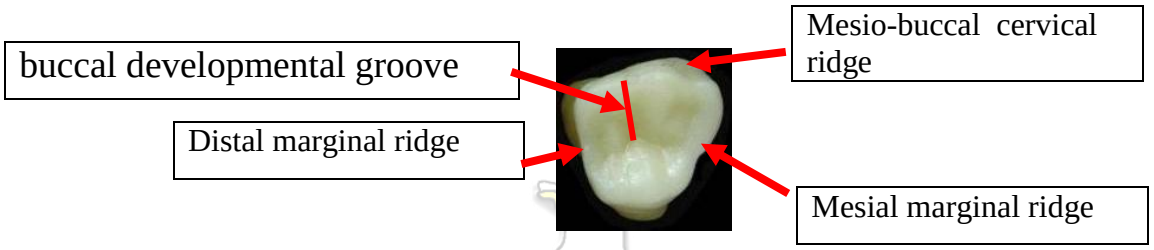


Fig. 69: Occlusal aspect of upper D three cusp type.

***Geometric outline** is rectangular.
-Distal and lingual convergence.

-The thickness is greater than width.

Elevations:

-*In the three-cusp type* (Fig. 69): a large mesio-buccal cusp, an indistinct disto-bucal cusp and a large lingual cusp are present.

Fig. 70: Occlusal aspect of upper D four cusp type.

-*In the four-cusp type* (Fig. 70): there are two large cusps (mesio-buccal & mesio-lingual) and two very small cusps (disto-buccal & disto-lingual). Sometimes an ***oblique ridge*** connects the mesio-lingual and disto-buccal cusps of the four-cusp type molar.

-Mesial and distal marginal ridges are present. The distal marginal ridge is thin and poorly developed.

Depressions:

-Central fossa in the middle of the occlusal surface, mesial and distal triangular fossae are seen.

-A central developmental groove runs mesiodistally and connects the mesial, central and distal fossae.

-A buccal developmental groove arises from the central fossa dividing the two buccal cusps and does not extend on the buccal surface.

-A disto-occlusal (or disto-lingual) developmental groove arises from the distal triangular fossa and extend obliquely between the two lingual cusps. It may or may not extend to the lingual surface.

-The triangular fossa appeared more clear than the distal one. A supplemental groove is running from inside the mesial triangular fossa and sometimes traverses the mesial marginal ridge to extend for a some distance on the mesial surface.

-There are usually three pits: mesial, central and distal.

Maxillary second deciduous molar (Fig. 71)

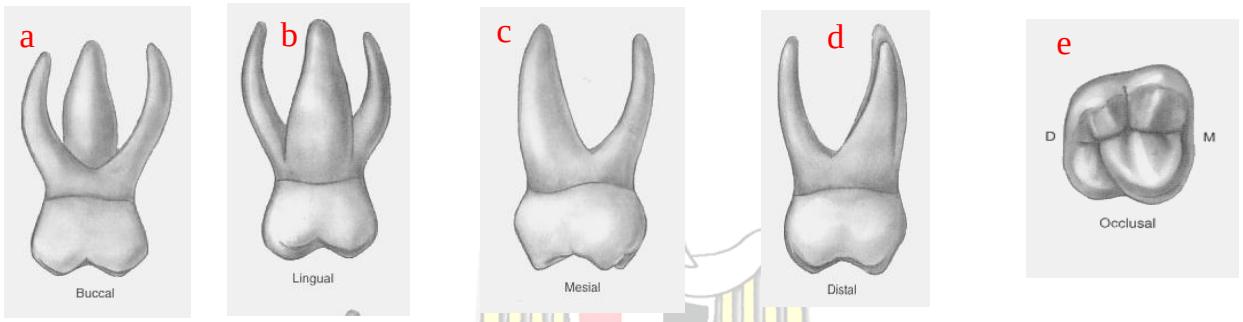


Fig. 71: Different aspects of maxillary second deciduous molar, buccal (a), lingual (b), mesial (c), distal (d) and occlusal (e) aspects.

Maxillary second deciduous molar is similar to **maxillary first permanent molar** except for the previously mentioned differences.

Mandibular second deciduous molar

This tooth does not resemble any of the other teeth, deciduous or permanent. Because it varies so much from all others, it appears strange and primitive.

1-Buccal aspect (Fig. 72):
Outline form: trapezoidal.

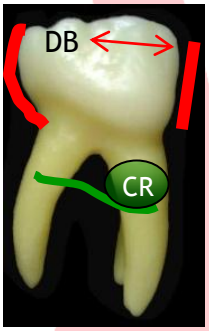


Fig. 72: Buccal aspect of lower first deciduous molar, mesio-buccal cusp (arrow), disto-buccal cusp (DB) and mesio-buccal cervical ridge (CR).

-The *mesial contour* of the crown is nearly straight, whereas the *distal side* is convex.

-The mesiobuccal cusp is much *wider* than the distobuccal cusp with *no groove* between them, just a depression.

-The cervical line is convex towards the root and ***slopes*** occlusally from mesial to distal. Thus the mesial portion of the crown is longer than the distal.

-The buccal surface has a very prominent cervical ridge with the most prominent part is present mesially (mesio-buccal cervical ridge).

-The mesial root is often wider and longer than the distal root.

-The roots are widely divergent and slender, and the furcation is close to the cervical line.

2-Lingual aspect (Fig. 73):
-The ***mesiolingual cusp*** is larger, longer, and sharper than all the other cusps.

-The mesial marginal ridge is so well developed that ***it resembles a cusp.***

-The cervical line is nearly ***straight***.

-The lingual surface is narrower than the buccal due to the lingual convergence.

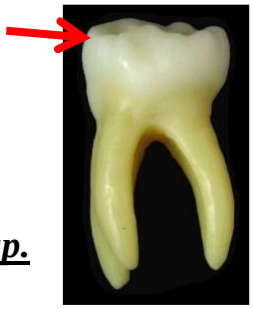


Fig. 73: Lingual aspect of lower first deciduous molar, with prominent mesial marginal ridge (arrow).

3-Proximal aspects (Fig. 74):
-Outline form: rhomboidal.
-*Buccal outline* is extremely convex at the cervical third representing the most prominent mesiobuccal cervical ridge then the buccal outline becomes straight till the tip of the mesiobuccal cusp.

-*Lingual outline* is convex with the maximum convexity is present in the middle third. ***It extend lingually*** beyond the confines of the root base.

Fig. 74: Mesial (a) and distal (b) surfaces of lower D.

-*Occlusal outline*: ***the occlusal table*** is small buccolingually.

Mesial aspect	Distal aspect
-2 mesial cusps appeared. The mesio-lingual is wider. -The **marginal ridge** is relatively long and wide.	-All cusps appeared as the distal surface is narrower and shorter than mesial one. -The **marginal ridge** is short and curved.

-*The cervical line* **mesially** is convex toward the occlusal .It slants occlusally from buccal to lingual while, the cervical line is almost straight **distally**.

-Roots:
Mesially, the mesial root outlines are straight from the neck till the apical third, then it tapers to end in a flat and broad apex. The root has a depression on most of its length.
Distally, both roots could be seen as the distal root is less broad, thinner, and shorter than the mesial root.

4-Occlusal aspect (Fig. 75)

Outline form: rhomboid.
-The crown is much wider mesiodistally than buccolingually.
-The mesiobuccal angle is acute and prominent because of the mesiobuccal cervical ridge on the buccal surface. The distobuccal angle is obtuse.

Fig. 75: Occlusal aspect of lower first deciduous molar.

-The mesiolingual cusp is pointed, and angled in the occlusal table.

-Mesial and distal marginal ridges are well developed with the mesial is more prominent than the distal one.

-The occlusal anatomy is shallow.

-There is no central fossa.

-There is a short buccal groove and a short lingual groove extending from the central pit.

Mandibular second deciduous molar (Fig. 76)

Fig. 76: Different aspects of mandibular second deciduous molar, buccal (a), lingual (b), mesial (c), distal (d) and occlusal (e) aspects.

Mandibular second deciduous molar is similar to **Mandibular first permanent molar** except for the previously mentioned differences. The buccal cusps of **mandibular second deciduous** molar are equal and called mesiobuccal, middle and distobuccal.

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