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‘ANATOMICAL AND MORPHOLOGICAL DIFFERENCE BETWEEN PRIMARY AND PERMANENT TEETH ‘

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Abstract-

Knowledge of primary, mixed and permanent dentition is not only important for a dentist but also has an importance for forensic and anthropological studies. The path of eruption, shedding time and time of root completion should be known. In case of surgical removal of primary teeth, it should be kept in mind that wrong approach can disturb the permanent tooth bud which develops from the lingual/distal extension of the dental lamina. In case of trauma or fracture, the dentist must be able to analyse whether the tooth will go for apexification or apexogenesis (pulpotomy) or pulpectomy. The physiological mobility of primary teeth should not be considered as pathological. The difference between primary and permanent dentition is expected from the dentist. Sometimes the permanent tooth which is newly erupted has the mobility due to lack of root completion, all these factors should be kept in mind. Maintaining the space due to premature shedding has a special reason, not giving the importance at this stage and considering it as a physiological process can cause malocclusion, causing changes in occlusion and facial profile, which will become more problematic in future. The morphology and histology of both primary and permanent teeth provides the knowledge for restoration. The shape, pulp horn and enamel rods are different. Taking all of that into consideration, the shape, depth and gingival seat of cavity preparation differs. This chapter deals with primary, mixed and permanent phases of dentition. First let us have a brief discussion about prenatal, postnatal and old age skull, which gives us an idea about the phases of development of face and skull.

Keywords-General differences , Eruption sequences ,Crown , Pulp ' Root ,Enamel ,Dentin Periodontium , Histological differences.

Introduction:

The estimation of age is an important and is commonly carried in medico legal area. Assessment of age is often required while administering justice to an individual involved in the civil and the criminal litigation.[1] Teeth are known to aid in personal identification and age estimation as they are highly durable and resist putrefaction, fire, chemicals etc.[2] Dental age estimation in the living is mostly based upon non-invasive methods, which evaluate the timing and sequence of defined growth stages of the developing dentition and the sequence or modification of traits in the mature dentition and the surrounding tissues.[3]

Primary teeth are also called as temporary , milk , deciduous or baby teeth. ' They are present from infancy stage till early teenage. ' Though they are erroneously considered as a annoyance , they play a major role in mastication and maintaining space for eruption of permanent teeth. ' Significant differences in different aspects distinguish them from their permanent counterparts.

The human dentition is termed heterodont . In comparison, a homodont dentition is one in which all of the teeth are the same in form and type.

This sort of dentition is found in some of the lower vertebrates. Sets of teeth: Diphyodont (Human): 2 sets of teeth – 1. Deciduous and 2. Permanent. Monophyodont Polyphyodont.

Deciduous dentition – Eruption : about six months to two years of age No. of teeth presents : 20 Other non-scientific name : "milk" teeth/" baby" teeth/ "temporary" teeth. • 2. Permanent dentition – Eruption: from 6-21 years of age. No. of teeth presents: 32

Feature	Deciduous	Permanent
Number	20, 5 in each quadrant	32, 8 in each quadrant
Type of tooth	CI, LI, C, 1 st M, 2 nd M	CI, LI, C, 1 st PM, 2 nd PM, 1 st M, 2 nd M, 3 rd M
Formula	2 1 2	2 1 2 3

Size	Small compared to Permanent	Large compared to Deciduous
Colour	White	Yellowish white to grey or brown
Placement	Perpendicular	Oblique
Eruption	8 months – 30 months	6 years – 25 years
Root Formation	1 year after eruption	3 years after eruption
Shedding	6 years to 10 years	No shedding

Dentition Periods and Succedaneous Dentition Periods and Succedaneous Teeth: Teeth: Three periods of dentition, since the deciduous and permanent dentitions overlap in time. These periods are summarized in the following manner: 1. Primary dentition period – 2. Mixed dentition period – 3. Permanent dentition Period- Morphological & Anatomical Difference

Morphological & Anatomical Primary & Permanent Tooth-

Primary Teeth Crown: - Shorter. - Narrow Occlusal table. - Constricted in cervical portion.

Permanent Teeth Crown: - Bigger - Broad Occlusal table. - Cervical constriction is not well marked.

Primary Teeth - Thinner enamel and dentin layers. - Enamel rods in the cervical area directed Occlusally. - Broad and flat contacts. - Color is usually lighter.

Permanent Teeth - Thick enamel and dentin layer. - Enamel rod in the cervical area directed Gingivally. Point contacts. - Color is much darker.

Primary Teeth - Prominent mesio-buccal cervical bulge seen in primary molars. - Incisors have no developmental grooves or mammelons. Permanent Teeth - Less prominent cervical bulge seen in permanent molars. - Incisors have developmental grooves or mamelons on newly erupted teeth.

Primary Teeth - Mandibular Incisors- central is symmetrically flat when viewed from buccal, lateral has a more rounded DI angle Maxillary Incisors- central is only tooth that has a greater width than height Permanent Teeth - Mandibular Incisors- Narrowest teeth mesio- distally - Maxillary Incisors- Widest teeth mesiodistally having two developmental

Primary Teeth -Maxillary 1st Molar- unique look, 3 cusps -Mandibular 1st Molar 4 cusps, transverse ridge dividing occlusal surface -Canines- maxillary is long and sharp, mandibular has similar shape but smaller.

Permanent Teeth -Maxillary 1st Molar- Roughly Trapezoidal,

Morphology – Crown

Feature	Deciduous	Permanent
Size	More Bulbous	Less Bulbous
Dimension	Wider MD than the crown length	Length is more than the width
Surface	Surface flat above the cervical ridge	Facial and lingual surfaces are convex
Mamelons	Mamelons absent	Mamelons are present
Occlusal Surface	Shallow occlusal surface	Deeper occlusal surface
Occlusal Area	Converge more occlusally	Wider occlusal area / table
Cingulum	Cingulum more prominent	Not prominent
Cusp	Short, sharp and pointed	Less sharp than deciduous
Contact Area	Small contact area, more gingival	Large contact area, middle third
Cervical Line	Less curved	More curved
Cervical Ridge	Prominent	Less pronounced
Cervical Constriction	Marked constriction	Less pronounced

MB & DB are two Buccal cusps. ML & DL line angle obtuse. Buccal developmental groove divides the two Buccal cusp. -Mandibular 1st Molar- 5 cusps, the tip of lingual cusp are higher than other. --Canines- maxillary is also sharp and long, the mesial slope is shorter than the distal slope

Primary Teeth Maxillary 2nd Molar – resembles permanent maxillary first molar but smaller. Mandibular 2nd Molar- resembles permanent mandibular first molar but smaller. Permanent Teeth Maxillary 2nd Molar 5th cusp is less evident Both distal cusp are less developed and crown is smaller in dimension Mandibular 2nd Molar Crown is shorter and narrower than the 1st molar. Buccal developmental groove b/w MB & DB. Root is distally tilted.

➤ Materials And Methods-

➤ General Anatomy Of The Tooth

➤ General Differences -

No. of teeth present:- primary-20 permanent – 28-32 ' Teeth formula:- ICPM/ICPM primary- 2102/2102 permanent- 2123/2123 ' Bicuspid and third molars are absent in the primary set of tooth. ' Primary teeth are smaller in size when compare to permanent teeth. ' 1st tooth to erupt into the oral cavity is mandibular incisor whereas in permanent teeth it is the mandibular first molar. ' Primate space is absent in primary teeth. ' Primary teeth are present within the age of 6 months-10 to 12 years (@ the age of 13 years only about 5% of primary teeth remains).

The Chronology of deciduous teeth

Deciduous Teeth	First evidence of calcification (weeks in utero)	Crown completion (months)	Eruption (months)	Root completion (years)
Maxillary Teeth				
Central incisor	14 (13-16)	11/2	10 (8-12)	11/2
Lateral incisor	16 (14-17)	21/2	11 (9-13)	2
Canine	17 (15-18)	9	19 (16-22)	3 1/4
1 st Molar	15 (14-17)	6	16 (13-19)	2 1/2
2 nd Molar	19 (16-24)	11	29 (25-33)	3
Mandibular Teeth				
Central incisor	14 (13-16)	21/2	8 (6-10)	11/2

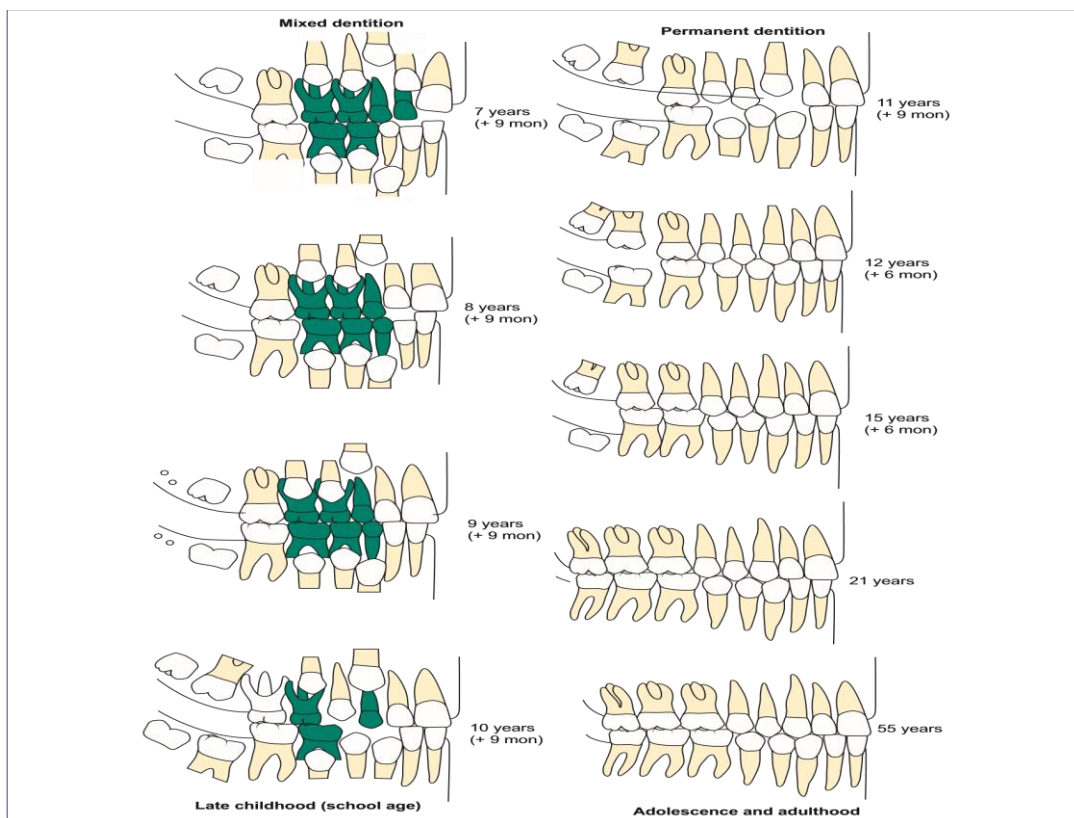
Lateral incisor	16 (14-17)	21/2	13 (10-16)	11/2
Canine	17 (16-18)	9	20 (17-23)	31/4
1 st molar	15 (14-17)	51/2	16 (14-18)	21/4
2 nd molar	18 (17-19)	10	27 (23-31)	3

The chronology of permanent teeth

Permanenet Teeth	First evidence of calcification	Crown completion (years)	Eruption (years)	Root completion (years)
Maxillary Teeth				
Central incisor	3-4 months	4-5	7-8	10
Lateral incisor	10-12 months	4-5	8-9	11
Canine	4-5 months	6-7	11-12	13-15
1 st Premolar	11/2-13/4 yrs	5-6	10-11	12-13
2 nd Premolar	2-21/2 yrs	6-7	10-12	12-14
1 st Molar	At birth	21/2-3	6-7	9-10
2 nd Molar	21/2-3 yrs	7-8	12-13	14-16
3 rd Molar	7-9 yrs	12-16	17-21	18-25
Mandibular teeth				
Central incisor	3-4 months	4-5	6-7	9
Lateral incisor	3-4 months	4-5	7-8	10
Canine	4-5 months	6-7	9-10	12-14
1 st Premolar	13/4-2 yrs	5-6	10-12	12-13
2 nd Premolar	21/4-21/2 yrs	6-7	11-12	13-14
1 st Molar	At birth	21/2-3	6-7	9-10
2 nd Molar	21/2-3 yrs	7-8	11-13	14-15
3 rd Molar	8-10 yrs	12-16	17-21	18-25

➤ Eruption Sequences

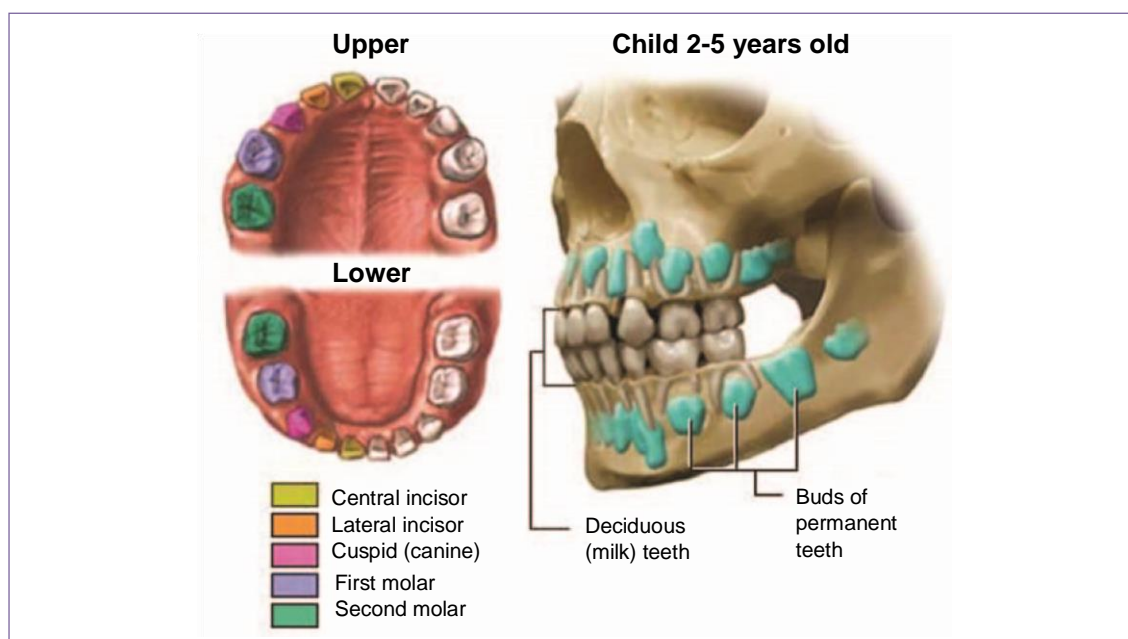
Eruption sequence follows a pattern – incisors-first molars- canines-second molars. ' This pattern is generally followed by both arches, with the mandibular arch preceding the maxillary arch. ' The loss of deciduous teeth tends to mirror the eruption sequence. ' Caries susceptibility is reverse of this order.



➤ FIG;=The eruption sequence

➤ Crown -

Bluish white in color. Refractive index similar to that of milk(RI=1). ' smaller in all dimensions . Exposed area is about one-half that of the permanent teeth. ' Wider mesio-distally in relation to cervico-occlusal dimension. this gives a cup shaped appearance to the anterior teeth and squat shaped appearance to the molars. ' Grayish white to yellowish white in color. ' Larger in dimensions. ' Larger in cervico-occlusal dimension than the mesio- distal dimension. this gives a longer appearance to permanent anterior teeth.



➤ FIG-Presence of permanent tooth bud

➤ Primary Teeth Permanent Teeth Cuspids -

Cuspids are slender and to be more conical. ' Cervical ridges are more pronounced especially on buccal aspect of first primary molar. ' Buccal and lingual surface of molars , especially 1st molar, converge towards occlusal surface so they have a narrow occlusal table in the bucco- lingual plane. ' Cuspids are less conical. ' The cervical ridges are flatter. ' There is less convergence of buccal and lingual surface of molars towards occlusal surface.

➤ Primary Teeth Permanent Teeth-

Occlusal plane is relatively flat. ' Molars are bulbous and are sharply constricted cervically. ' The contact areas between molars are broader , flatter and situated gingivally. ' Occlusal plane has relatively curved contour. ' They have less constriction at the neck. ' The contact point between permanent molars is situated occlusally.

➤ Primary Teeth Permanent Teeth Supplemental Grooves -

Supplemental grooves are more. ' Mammelons are absent. ' 1st molar is smaller in dimension than the 2nd molar ' Supplemental grooves are less. ' Mammelons are present on incisal edges of newly erupted incisors. ' 1st molar is larger in dimension than the 2nd molar.

➤ Primary Teeth Permanent Teeth Pulp-

Pulp (Pulp Chamber Anatomy In Both Primary And Permanent Teeth Closely Approximates The Surface Shape Of The Crown) -

Pulp chamber is larger in relation to crown size. ' Pulpal outline follows DEJ more closely. Pulp horns are closer to the outer surface. Mesial pulp horn extends to a closer approximation of surface than the distal pulp horn. ' High degree of cellularity and vascularity in tissue. ' High potential for repair. ' Pulp chamber is smaller in relation to crown size. ' Pulpal outline follows DEJ less closely. ' The pulp horns are comparatively away from the outer surface. Comparatively less degree of cellularity and vascularity in tissue. ' Comparatively less potential for repair.

➤ Primary Teeth And Permanent Teeth-

Comparatively less tooth structure. ' Greater thickness of dentin over occlusal fossa of molars. ' Root canals are more ribbon like. the radicular pulp follows a thin , tortuous and branching path. ' Floor of pulp chamber is porous. Accessory canals in primary pulp chamber floor leads directly into inter- radicular furcation. ' More tooth structure protecting the pulp. ' Comparatively lesser thickness of dentin over the pulpal wall at the occlusal fossa of molars. ' Root canals are well defined with less branching. ' Floor of pulp chamber does not have any accessory canal.

➤ Primary Teeth And Permanent Teeth Root -

Roots are larger and more slender in comparison to crown size. ' Furcation is more towards cervical area so that root trunk is smaller . ' Roots are narrower mesio-distally. ' At the cervical region, the roots of the primary molars flare outward and continue to flare as they approach the apices to accommodate permanent tooth buds. ' Undergo physiologic resorption during shedding of primary teeth. ' Roots are shorter and bulbous in comparison to crown. ' Placement of furcation is apical , thus the root trunk is larger. ' Roots are broader mesio- distally. ' Marked flaring of roots is absent. ' Physiologic resorption is absent.

➤ Primary Teeth And Permanent Teeth Enamel -

Bands of retzius are less common. This maybe partly responsible for the bluish white color. ' Neonatal lines are present in all teeth. ' Enamel is thinner and has a more consistent depth of about 1mm thickness throughout the entire crown ' Enamel rods at the cervical slopes occlusally from the DEJ. ' Bands of retzius are more common. ' Neonatal lines are only present in 1st molars ' The enamel is thicker and has a thickness of about 2-3mm. ' Enamel rods are oriented gingivally.

➤ Primary Teeth Permanent Teeth Dentin –

Dentinal tubules are less regular. ' Dentin thickness is half that of permanent teeth. Thickness is limited in some places. ' Less dense and easy to cut. ' Interglobular dentin is absent. ' Dentinal tubules are more regular. ' Den. ' Dentin is thicker. ' Dentin is denser and difficult to cut. ' Interglobular dentin is present.

➤ Primary Teeth Permanent Teeth Periodontium –

Cementum is very thin and o the primary type. Secondary cementum is characteristically absent. ' Alveolar atrophy is rare. ' Gingivitis is generally absent in a healthy child. Similarly recession is in frequent. ' Secondary cementum is present. ' Alveolar atrophy occurs. ' Gingivitis is common in adults.

➤ Primary Teeth Permanent Teeth Histological Differences –

Roots have enlarged apical foramens. Thus , the abundant blood supply demonstrates a more typical inflammatory response. ' Incidence of reparative dentin formation beneath carious lesion is more extensive and irregular. ' Pulp nerve fibber's pass to the odontoblastic area, where they terminate as free nerve endings. ' Foramens are restricted. Thus reduced blood supply favour's a calcific response and healing by calcific scarring. ' Reparative dentin formation is less. ' Pulp nerve fibres terminate mainly among the odontoblasts and even beyond the predestine.

➤ Primary Teeth Permanent Teeth-

Density of innervations is less because of which primary teeth are less susceptible to operative procedures. Neural tissue is the first to degenerate when root resorption takes place. ' Localization of infection and inflammation is poorer in pulp ' Density of innervations is more. ' Infection and inflammation in pulp is localized .

➤ Primary Teeth Permanent Teeth Individual Differences In Tooth Morphology-

➤ Maxillary Central Incisor


Mesio-distal measurement is greater than cervico-incisal measurement. ' Labial surface is slightly convex with little evidence of developmental grooves. ' The incisal edge joins the mesial surface at an acute angle and the distal surface at a more obtuse angle.

➤ Maxillary Lateral Incisor

Smaller in most dimensions. ' Disto-incisal angle is more rounded. ' Lingual anatomy is less prominent. ' Root is longer in proportion to the crown.

➤ Maxillary Canine ' Larger than incisors in all dimensions. ' All crown surfaces the are convex creating a more pronounced constriction at the cervix prominent cusp. ' Lingual surface presents a lingual ridge , fossa and marginal ridges. ' The root is long and tapered toward the apex, and shows increase in diameter just apical to the cervical line.

➤ Mandibular Central Incisor



Smaller in all dimensions than MCI. ' Labially appears symmetric, less convex and smooth without evidence of developmental grooves. ' Lingual surface is usually smooth with poorly defined fossa and marginal ridges. ' Root is long and evenly tapered toward the apex.

➤ Mandibular Lateral Incisors

Similar in morphology to that of CI, except that the incisal edge slopes downward distally forming a more obtuse disto-incisal angle. ' Slightly larger cervico- incisally and mesiodistally than CI. ' Root is conical, longer than that of CI and shows definite inclination at the apex. ' Distal surface of the root will show a longitudinal depression or groove separating labial and lingual surfaces.

➤ Mandibular Canine –

Appears more slender than MC because of smaller mesio-distal diameter in relation to crown height ' The disto-incisal edge is longer. ' Marginal ridges and cingulum are less prominent. ' Labio-lingual diameter is smaller than MC. ' Root is smoothly tapered from the cervical line to the apex.

➤ Maxillary First Molar –

Appears triangular when viewed occlusally. ' Proximal surfaces converge lingually creating a crown that is wider mesio- distally at the bucal surface. ' Mesio-lingual cusp is the largest followed by mesio-

buccal and disto- buccal. ' Mesially , prominent bucco-cervical ridge can be seen ' 3 long and slender roots are present. ' Lingual root is the longest ' All three roots extend from a short root base in a divergent manner.

➤ Maxillary Second Molar -

- Similar to maxillary 1st permanent premolar (crown form, pit , groove and cusp arrangement. ' Four cusps. ' Largest is mesiolingual . Distobuccal is the smallest and other 2 are almost of the same size. ' Occlusal surface 3 pits which meet at the intersection of the developmental groove ' 3 roots. Lingual root is the largest and distobuccal is the smallest. ' Root morphology is similar to that of to that of 1st permanent molar except that roots are flared and diverge more from the root base.

➤ Mandibular 1st Molar -

When viewed from occlusal aspect the outline is rhomboidal in shape. ' 2 buccal cusps and 1 lingual cusp. ' 3 pits are found on occlusal surface of which the surface-central is most prominent. ' A distinguishing feature is heavy transverse ridge connecting the mesio- buccal and mesio-lingual cusps. ' 2 roots ; mesial and distal. They show typical flaring and end in a sharp edge which may be slightly bifid ' The most unique feature of this tooth is that is does not resemble any tooth in the permanent set.

➤ Mandibular 2nd Molar

- Smaller replica of the mandibular 1st permanent molar. ' 3 buccal cusps; distobuccal(largest),followed by the mesio -buccal and the distal. ' 2 lingual cups which are similar in size. ' 3 pits ; central(prominent) ,mesial, distal. ' Crown morphology shows typical cervical constriction and bucco-cervical ridge as seen of other primary molars. ' 2 roots ;mesial and distal. Narrow mesiodistally and broad buccolingually. Roots are more diverged than 1st molar

➤ Morphologic Considerations –

- Crowns are smaller and more bulbous than their permanent counterparts, and the molars are bell shaped , with a definite constriction in the cervical region ' The characteristic sharp lingual inclination occlusally of the facial surfaces results in the formation of distinct facio-gingival that ends abruptly at the CEJ. ' The sharp constriction at the neck of the primary molar necessitates special care in the formation of the gingival floor during class2 tooth preparation . ' The buccal and lingual surfaces of the molars converging sharply occlusally results in a narrow occlusal surface or food table. ' The pulpal outline follows the DEJ more closely than that of the permanent teeth . ' The pulpal horns are longer and more pointed than the cusps would indicate. ' The dentin also has less bulk or thickness, and so the pulp is proportionately larger than that of the permanent teeth . ' The enamel of primary teeth is thin but of uniform thickness . The enamel surface tends to be parallel to the DEJ.

- Root - ' Roots are larger and more slender in comparison to crown size. ' Furcation is more towards cervical area so that root trunk is smaller . ' Roots are narrower mesio-distally. ' At the cervical region, the roots of the primary molars flare outward and continue to flare as they approach the apices to accommodate permanent tooth buds. ' Undergo physiologic resorption during shedding of primary teeth. ' Roots are shorter and bulbous in comparison to crown. ' Placement of furcation is apical , thus the root trunk is larger. ' Roots are broader mesio- distally. ' Marked flaring of roots is absent. ' Physiologic resorption is absent.

- Causes of permanent tooth loss-

Accident –

The most common cause for tooth loss is trauma, especially in children. Most of them are boys, 63% of traumatic tooth loss is due to falls. Other causes are traffic accidents and violence.

Contact sports-

In spite of taking all necessary precautions in contact sports, like placement of mouth guards to players, a minor portion of traumatic loss belongs to this category, especially when the teeth are in direct contact by trauma. Example: Boxing, rugby.

Psychotic patients In these patients, the main cause of tooth loss is failure to maintain oral hygiene. But some of the disorders like Lesch-Nyhan syndrome, in which patient has spastic cerebral palsy and mental retardation. There is a peculiar self-mutilating aggressive behavior. The patient tries to mutilate his body parts like chewing of fingers, lips and tongue. In these cases, prophylactic extraction is important to prevent injury. Hereditary The hereditary conditions which can cause loss of teeth are either autosomal dominant, autosomal recessive or x-linked, which are genetically determined or transferred by chromosomes. The description, clinical features and etiology of each disease will be discussed in detail in Oral Pathology.

- **Discussion-**

Primary Teeth - Develops directly from dental lamina. –

Premolars –Absent - Relation b/w upper and lower teeth is tooth-to tooth relation (Edge to edge). - Mesiodistal diameter of crown is more than cervico incisal length. Permanent Teeth - Develops as lingual or distal extension of dental lamina. - Premolars-Present - Intercuspatation relation. - Cervico incisal length is more than the mesiodistal dimension.

Primary Teeth - More prone to acid attack, thus rapidly demineralised to dental caries. - Neonatal lines are seen. - Dentin is less mineralised . - Lamina dura is relatively Permanent Teeth - Less prone to caries attack. - Neonatal lines is not seen in Permanent teeth except in Permanent 1st molars. - Dentin is more mineralised. - Lamina dura is relatively thin.

- Conclusion • Teeth vary in size, shape and their location in the jaws. These differences enable the teeth to work together to help you chew, speak and smile. They also help give your face its shape and form.

At birth people usually have 20 primary (baby) teeth, which often erupt as early as six months of age. They are then shed at various times throughout childhood. By age 21, all 32 of the permanent teeth have usually erupted. As per pedodontics point of view the things that need to be remembered are-

- 1. enamel and dentin in child patient are thinner as compared to adult.
- 2.pulp chamber are wider in children.
- 3.pulp horn are more prominent.
- 4.smaller root trunk.
- 5.ribbon like root canal.

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