

Development of Dentition

The Mixed Dentition stage (6-12 YEARS):

The mixed dentition stage starts with the eruption of the first permanent tooth, and is normally completed at the time the last primary tooth is shed. The mixed dentition period is characterized by significant changes in the dentition as a result of the loss of 20 primary teeth and the eruption of their succedaneous permanent teeth, so most malocclusion developed at this stage.

Phases of mixed dentition stages:

❖ *Early 1st transitional period (6-8.5 years):*

Two important events take place during this stage, the eruption of permanent first molars and the replacement of incisors. The erupting first permanent molars are guided by the distal surfaces of the second primary molars as they erupt into occlusion. In patient with spaced primary dentition, and flush terminal plane relationship, the permanent mandibular first molars initially emerge or erupt into a cusp- to- cusp or end on molar relationship, the lower first permanent molar has to move 2-3mm anteriorly in relation to the upper first permanent molar to transform the end on molar relationship to class I molar relation. This transformation occurs in two ways:

1- Early mesial shift: It is the mesial movement of the erupting lower permanent first molar by utilization of the *lower primate spaces* in the early mixed dentition period to establish class I molar relationship.

2-Late mesial shift: It is the mesial movement of the lower permanent first molar in the late mixed dentition period following the exfoliation of the second primary molars to establish class I molar relationship by utilization of *the leeway space*.

Leeway space: is the difference between the combined mesiodistal crown width of the primary canine, and primary first and second molars which is greater than the combined mesiodistal crown width of their successors namely permanent canine, first and second permanent premolars. The amount of space gained by this difference is greater in the mandible in which the total leeway space is about **3.4 mm (1.7 mm per quadrant)** than the total leeway space in the maxilla which is about **1.8 mm (0.9 mm in each quadrant)**.

❖ *First stage for permanent teeth emergence is:*

Lower 6	6 years.
Upper 6	6 - 6.2 years

Lower 1 6.5 years
 Upper 1& lower 2 7.5 years
 Upper 2 8 - 8.5 years.

About the eruption of the permanent incisors:

The collective mesiodistal dimensions of the permanent incisor tooth crowns are larger than their deciduous predecessors. This difference between the space needed for the incisors and the amount of the available space is known as the ***incisor liability***. This increased space requirement for the permanent incisor teeth to align properly is gained from the following:

- 1- Interdental (developmental) spacing present between the deciduous incisors: spaces present in primary dentition helps in the alignment of the permanent incisors.
- 2- Labial eruption of incisor: permanent incisors erupting into a more labial position (particularly in the maxilla) than their deciduous predecessors and therefore occupying a greater arch perimeter.
- 3- Transverse increase in the inter canine arch width: during the period of the permanent incisor eruption, a slight increase in the width of the arches across the canines occurs, which is about 2-3 mm.
- 4. Deciduous canines being moved distally into the primate space as the incisors erupt.

❖ *Inter transitional period (8.5-10 years):*

This phase of mixed dentition is relatively stable in which little changes in occlusion is seen including: the anteroposterior and vertical dimension. This period is called (Lull period). In this period, the teeth present are:

6EDC21	12CDE6
6EDC21	12CDE6

❖ *Second transitional period (10-13 years):*

This period involves replacement of deciduous molars and canines by the premolars and permanent canines respectively and the emergence of second permanent molars. As a general rule in the mandible, the canine erupts ahead of the first premolar and this is followed by the second premolar; and in the

maxilla, the first premolar usually erupts first, followed by the second premolar and then canine. The consequences of these eruption patterns are that the mandibular second premolar and maxillary canine teeth are the most vulnerable for potential crowding. The final part of this phase of dental development occurs with eruption of the second permanent molars, usually at around 12 years of age.

❖ ***Second stage for permanent teeth emergence is:***

Lower 3 and upper 4 10 years.

Lower 4 10.5 years

Upper 5 and lower 5 11 years

Upper 3 11.5 years

Upper and lower 7 12 years

At approximately 13 years of age all permanent teeth except the third molars are fully erupted.

✓ **Most common eruption sequence in maxilla is :6-1-2-4-5-3-7-8.**

✓ **Most common eruption sequence in mandible is: 6-I-2-3-4-5-7-8 Or
6-I-2-4-3-5-7-8**

The Broadbent's phenomenon, Ugly Duckling Stage:

It is a transient form of malocclusion with appearance of midline diastema and flaring of upper incisors is often observed to develop in the maxillary anterior region during 8-12 years, which corresponds to the eruption of permanent maxillary canines.

During the eruptive stages of the permanent canine, it impinges on the roots of the developing lateral incisors, thus driving the roots medially and causing their crowns to flare laterally. This pressure is transmitted to the central incisors also. This bilateral effect causes a midline diastema, which is transient and closed automatically as the canine comes into occlusion.

variation exist in this period includes:

Malposition or impaction of lower 5 since it is the latter tooth which is erupted in the mandibular arch mesial to the lower 7. While in the maxilla the canine is the latter tooth that erupts prior to the upper 7s so it's the tooth most likely subjected to malposition or impaction.

The upper canine is influenced by the problem of malocclusion in a great

amount in comparison to the other teeth due to its long path of eruption "development" since its early development occur under the orbit.

For the canine to developed normally, it should firstly directed mesially until it touches the apical part of the root of the lateral incisors, then it directed into a downward direction, and lateral direction till reaches the occlusal level. If the root of the lateral incisor is abnormal or the lateral is missed, then the canine will lose its guidance plane of eruption and it will be erupted in any- direction or in any situation; therefore it will be subjected to more problem of malocclusion due to its tortuous path of eruption and due to the lack of space available for it, and due to its dependence on the presence or absence of the permanent lateral incisors.

The permanent dentition stage (13 years and beyond):

The appearance of the third molars is the final stage in establishing the permanent dentition. The third molars erupt between 18 to 24 years of age. The upper 8s developed at the postero-inferior position of the maxillary tuberosity, so, these teeth are subjected to a high amount of crowding in comparison with the 6s or 7s due to the lack of space available for them. The lower third molar may be subjected to impaction due to lack of space. Third molars may be absent congenitally.

Characteristics features of occlusion in the permanent dentition:

1. Coincide midline.

2.Overlap: The maxillary teeth overlap the mandibular teeth, both in labial and buccal segments in centric occlusion.

3. Intra-arch tooth contacts: with the exception of the maxillary third molar and mandibular central incisors, each permanent tooth has two antagonistic teeth.

4. Angulation: permanent teeth have bucco-lingual inclination and mesiodistal angulations.

5.Arch Curvatures. The antero-posterior curvature exhibited by the mandibular arch is called the curve of spee. The corresponding curve in the maxillary arch is called the compensating curve. The bucco-lingual curvature from one side of the arch to the others is called "curve of Wilson".

6. Incisor relationship. The vertical overlap between maxillary and mandibular incisors is called overbite and is about 1 -3mm and the horizontal overlap called the overjet is generally between 2-3 mm.

7.Molar relationship: In permanent dentition stage, the class I molar relationship is the ideal relationship.

The times of Calcification of the permanent teeth:

Upper & lower 6 → at birth.

Upper 1,3 and lower 1,2,3 → 3-4 months after birth.

Upper 2 → 1 year

Upper 4 and lower 4 → 1.8- 2years of age.

Upper and lower 5 and 7 → 2.5- 3 years of age.

Upper and lower 8 — 8-9 years of age.

These periods of calcification are of a great significant for the orthodontist, since by taking an x - ray it can be known that if there is a development of teeth or not, i.e. if there is missing teeth. Ex: at age of 10 years it can be known (50% of cases) if the third molars will be developed or not, (missed), by taking an x-ray film.

Summary of dental development and eruption sequence for the permanent teeth:

- ***Dental age 6:***

- Eruption of lower 1 and upper and lower 6.
- Mandibular molar eruption proceeds maxillary molars.

- ***Dental age 7:***

- Eruption of upper 1 and lower 2.
- Root formation of maxillary lateral incisors well advanced.
- Crown completion of canines and premolars.

- ***Dental age 8:***

- Eruption of upper 2.
- Delay of 2-3 years before any further teeth erupt.

- ***Dental age 9:***

- The upper 2 have been in place for 1 year.
- Root formation of the other incisors and first molars is nearly completed.
- Root development of upper 3 and all 5s is just beginning, while about one third of the root of lower 3 and all of the 4s have been completed.

- ***Dental age (10-11):***

- Dental age 10-11 is characterized by the more or less simultaneous eruption of the lower 3 and upper and lower 4s.
- One-half root formation of lower 3 and 4s is completed.
- Significant root development of upper and lower 5 and upper 3.

- Root completion of lower incisors and near completion of upper 2.
- ***Dental age 12:***
 - Dental age 12 is characterized by eruption of the remaining succedaneous teeth (the upper 3 and upper and lower 5s), and a few months later, the upper and lower 7s.
- ***Dental age 15:***
 - The roots of all permanent teeth except the third molars are completed, and crown formation of third molars often has been completed.