Development of occlusion

The development of dentition is an important part of craniofacial growth as the formation, eruption, exfoliation and exchange of teeth take place during this period.

According to Angle occlusion is "The normal relation of the occlusal inclined planes of the teeth when the jaws are closed"

According to Ash and Ramfjord occlusion is the "The contact relationship of the teeth in function and parafunction"

Periods of occlusal development can be divided into the following development periods:

1-Neo-natal period (at birth).
2- Primary dentition period.
3- Mixed dentition period.
4- Permanent dentition period

Neonatal period

Alveolar processes at the time of birth known as gum pads. Which is Pink in color, firm and are covered by a dense layer of fibrous periosteum , the pads get divided into 'labio- buccal' & 'lingual portion', by a dental groove, and gum pad soon gets segmented into 10 segment by a groove called transverse groove, & each segment is a developing tooth site. The groove between the canine and the 1st molar region is called the lateral sulcus which helps to judge the inter-arch relationship.

The upper gum pad is horse shoe shaped, shows

- Gingival groove separates gum pad from the palate
- Dental groove starts at the incisive papilla, extends backward to touch the gingival groove in the canine region & then moves laterally to end in the molar region
- Lateral sulcus

The lower gum pad U shaped, characterized by

- Gingival groove: Lingual extension of the gum pads.
- Dental groove: Joins gingival groove in the canine region.
- Lateral sulcus.

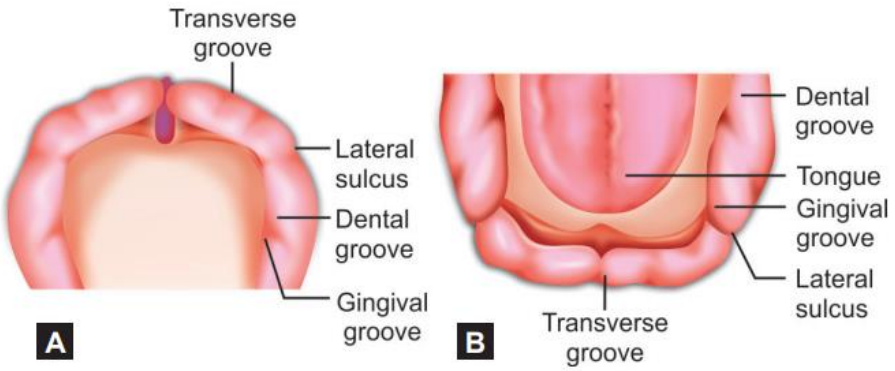


Fig. 1; the gum pads: (A) Maxillary; and (B) Mandibular arches

Relationship of gum pads

- Anterior open bite is seen at rest with contact only in the molar region, this will facilitate the feeding process without discomfort to the mother. The intermaxillary space closure, occurs with eruption of primary teeth.
- Complete overjet.
- Class II pattern with the maxillary gum pad being more prominent.
- Mandibular lateral sulci posterior to maxillary lateral sulci.
- Mandibular functional movements are mainly vertical and to a little extent anteroposterior. Lateral movements are absent.

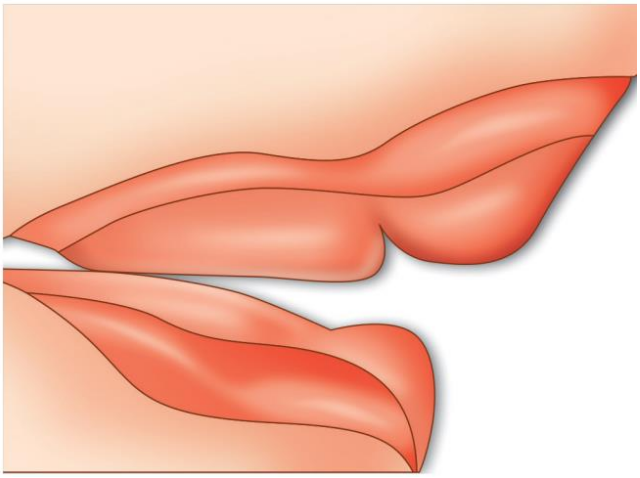


Fig. 2: Relationship between upper and lower gum pads: infantile open bite seen at birth. Also note that mandibular lateral sulcus is posterior to maxillary lateral sulcus

Precociously Erupted Primary Teeth

The newly born child mouth is usually without teeth, sometimes Natal teeth that are present above the gum line (have already erupted) at birth. Neonatal teeth or Early Infantile teeth that erupt during the 1st month of life these teeth look like the deciduous teeth. They are contained enamel, dentine and pulpal tissue and usually without roots or there is a very short root with them. No intervention is usually recommended unless they are causing difficulty to the infant or mother. The incidence of natal and neonatal teeth

is estimated to be l:1000 and 1:30000 respectively. These teeth are almost always mandibular incisors, which frequently display enamel hypoplasia. There are familial tendencies for such teeth. They should not be removed if normal but removed if supernumerary or mobile.

Fig. 3 ; Natal teeth: a child who had erupted lower central incisors at birth

Deciduous Dentition

Deciduous teeth or primary teeth, are the first set of teeth in the growth development of humans. They develop during the embryonic stage of development starts at the sixth week of tooth development as the dental lamina, there are ten buds on the upper and lower arches that will eventually become the primary (deciduous) dentition. These teeth will continue to form until they erupt and become visible in the mouth during infancy, there are a total of twenty teeth that is made up of central incisors, lateral incisors, canines, first molars, and secondary molars; there is one in each quadrant, making a total of four of each tooth: five per quadrant and ten per arch. The eruption of these teeth (teething) starts from the eruption of the first deciduous tooth, usually the deciduous mandibular central incisors and ends with the eruption of the first permanent molar, i.e. from 6 months to 6 years of postnatal life. By 2½ years of age, deciduous dentition is usually complete and in full function. Root formation of all deciduous teeth is complete by 3 years of age.

The sequence of eruption and shedding of deciduous teeth;

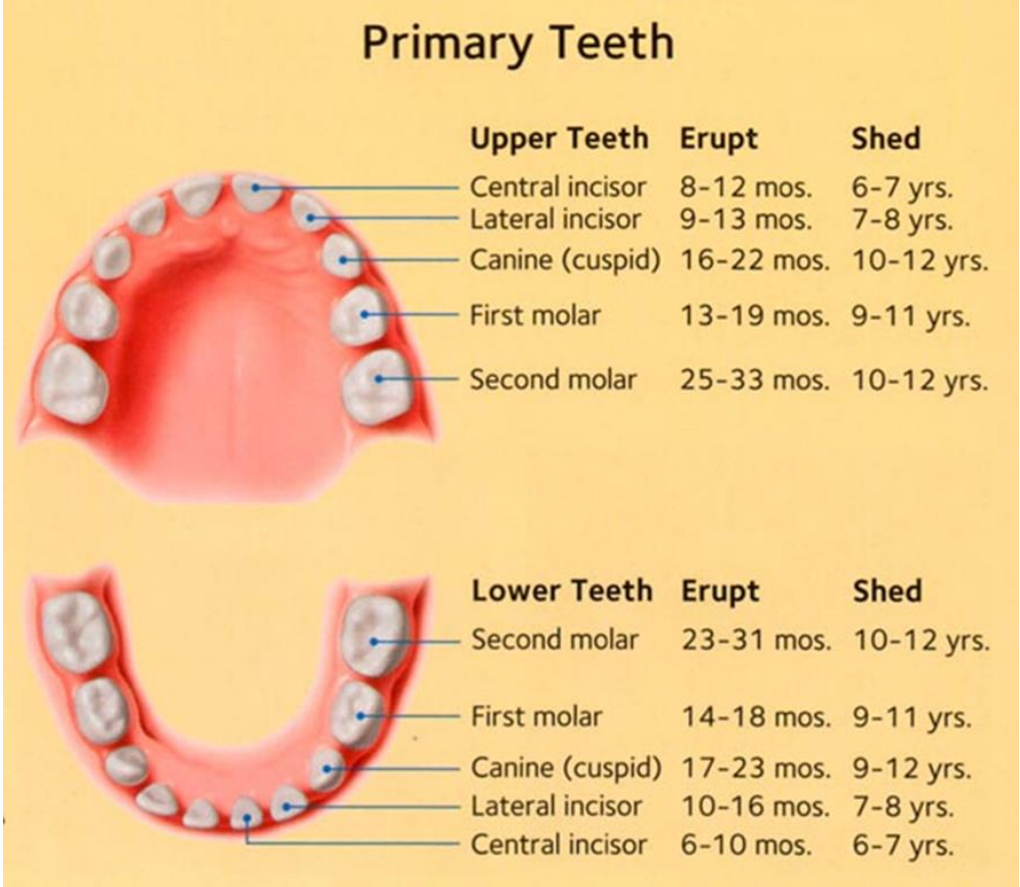


Fig. 4; Primary teeth eruption time table.

Normal Signs of Primary Dentition

1- Ovoid arch form
2- Striaght or vertical inclinion of the incisors
3- Deep bite are present this could be duo to vertical inclination of primary incisors over aperiod of time these deep bite reduced duo to eruption of primary molars ,rapid attrition of incisors and forward movement of the mandible due to growth , and which change to edge to edge relationship
4-Minimal overjet and absence of crowding.

Two types of primary dentitions seen

A- Closed primary dentition: absence of spaces is an indication that crowding of teeth may occur when the larger permanent teeth erupt.
B- Spaced or opened primary dentition: in which interdental spaces are present called spaced dentition there are 2 types of spacing.
1- Physiologic or generalized spaces: usually seen in the deciduous

dentition to accommodate the larger permanent teeth in the jaws, more prominent in the anterior region.

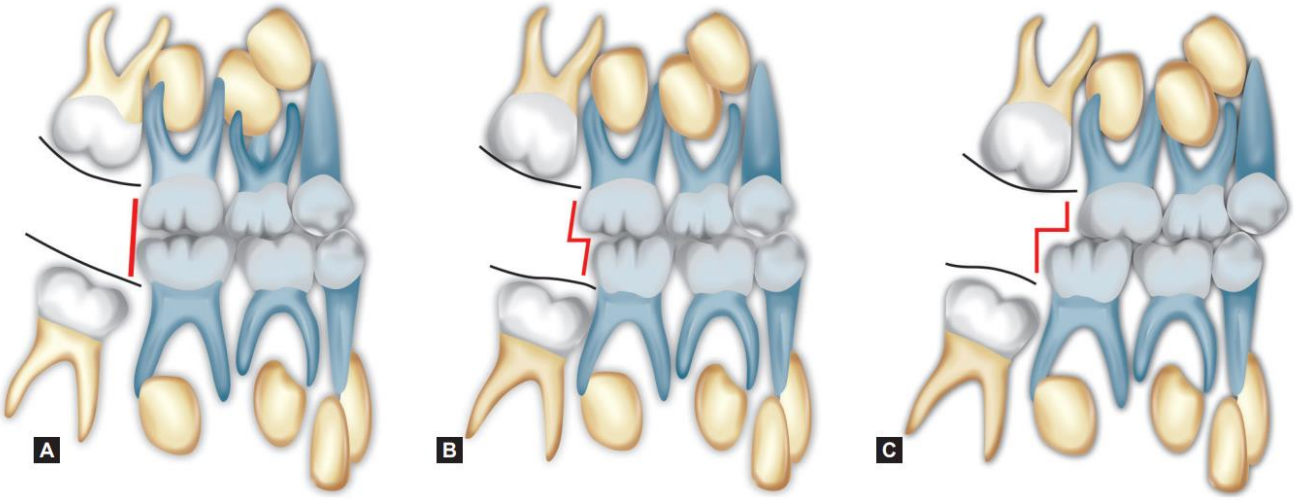
Fig 5; Physiological spacing in primary dentition

2- Primate spaces or anthropoid spaces: naturally occurring spacing between the teeth of the primary dentition. In the maxillary arch, it is located between the lateral incisors and canines, where as in the mandibular arch the space is between the canines and first molars, this space is used for early mesial shift

Fig 6 ; Physiological spacing in primary

Molar Relationship

The anteroposterior molar relationship in deciduous dentition is described in terms of the terminal planes. Terminal planes are the distal surfaces of the maxillary and mandibular second primary molars. Moyers described three possible kinds of primary molar relationships (fig. 7).



Figs 7: A. Straight/Flush terminal plane B. Mesial step C. Distal step.

Mixed Dentition Stage (6–12 Years)

Mixed dentition stage is a transition stage when primary teeth are exfoliated in a sequential manner, followed by the eruption of their permanent successors. This stage spans from 6 years to 12 years of age, beginning with the eruption of the first permanent tooth, usually, a mandibular central incisor or a first molar. It is completed at the time, the last primary tooth is shed. Significant changes in occlusion are seen in mixed dentition period due to the loss of 20 primary teeth and eruption of their successor permanent teeth. Most malocclusions are developed at this stage. Mixed dentition stage can be divided into the following phases:

- Early/1st transitional period
- Intertransitional period
- Late/2nd transitional period.

First Transitional Period

Emergence of the first permanent molars and transition of incisors. The following events take place during this period

Eruption of Permanent First Molars

The first permanent molars erupt at 6 years. They play an important role in the establishing and in the functioning of occlusion, in the permanent dentition. Anteroposterior positioning of the permanent molars is influenced by:

1. Terminal plane relationship (Fig. 8)
    - When the deciduous second molars are in a flush terminal plane, the permanent first molar erupts initially into a cusp-to-cusp

relationship, which later transforms into a Class I molar relation using the primate spaces. Later, cusp-to-cusp relationship of the permanent first molar can be converted to a Class I relationship by the mesial shift of the permanent first molar following exfoliation of the primary molar and thus making use of the Leeway space (late mesial shift.

- When the deciduous second molars are in a distal step, the permanent first molar will erupt into a Class II relation. This molar configuration is not self-correcting and will cause a Class II malocclusion despite Leeway space and differential growth.
- Primary second molars in mesial step relationship lead to a Class I molar relation in mixed dentition. This may remain or progress to a half or full cusp Class III with continued mandibular growth.

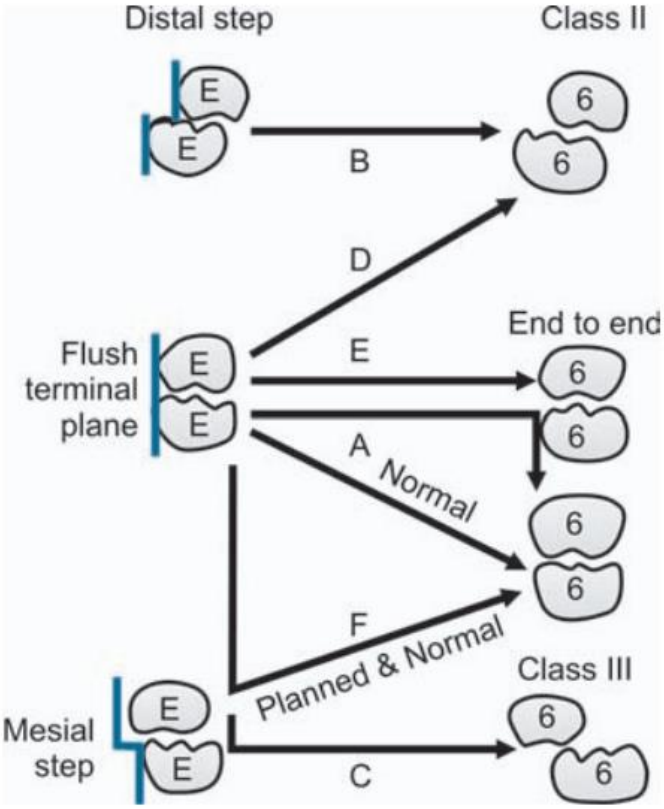


Fig. 8 Occlusal relationships of primary and permanent molars

2. Early mesial shift in arch with physiologic spacing: In a spaced arch, eruptive force of the permanent molars causes closing of any spaces between the primary molars or primate spaces, thus allowing molars to shift mesially (Fig. 9).
3. Differential growth of maxilla and mandible.

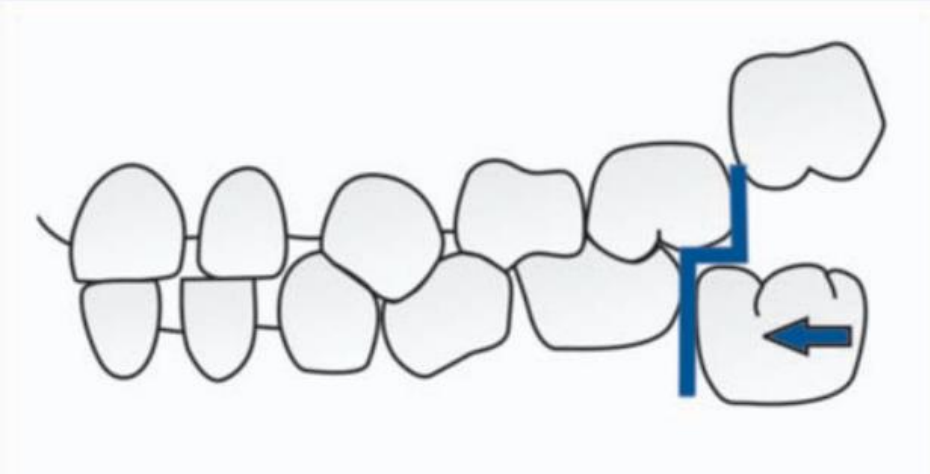


Fig. 9; Early shift of the erupting first permanent molars moving utilizing the primate spaces

Leeway space of Nance

The combined mesiodistal widths of deciduous canine, first and second molars is more than that of the combined mesiodistal width of permanent canine, first and second premolar (Fig. 10). The difference between the two is called the Leeway space. Maxilla 0.9 mm/segment = 1.8 mm total Mandible 1.7 mm/segment = 3.4 mm total.

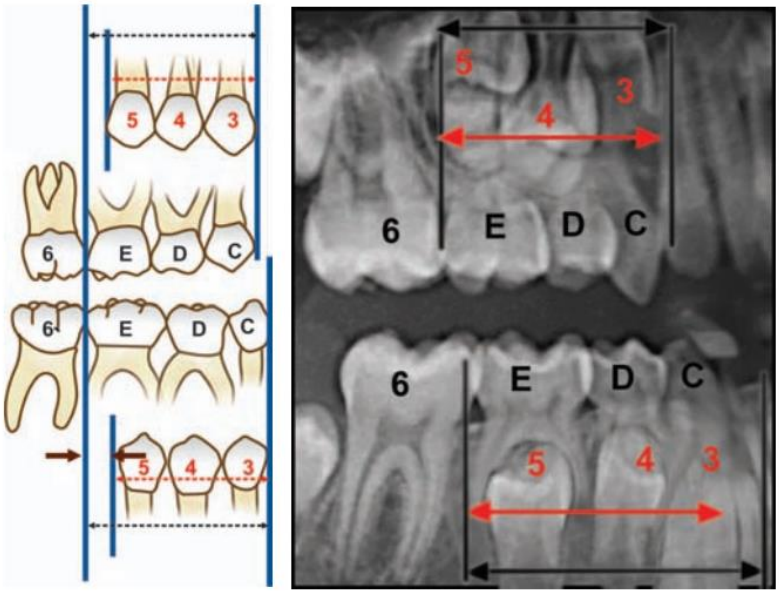


Fig. 10; Leeway space of Nance

Incisor Eruption

Permanent incisors develop lingual to the primary incisors. For incisors to erupt in normal alignment, there is an obligate space requirement in the anterior part of both the arches which is termed as incisor liability, i.e. the total sum of the mesiodistal width of four permanent incisors is larger than that of primary incisors by 7.6 mm in maxilla and 6 mm in mandible. This obligate space is provided by:

• Interdental physiologic spacing in the primary incisor region: 4 mm in maxillary arch; 3 mm in mandibular arch.

• Increase in the inter-canine arch width: Significant amount of growth occurs with the eruption of incisors and canines.

• Increase in the anterior length of the dental arches: Permanent incisors erupt labial to the primary incisors to obtain an added space of 2-3 mm.

• Change in inclination of permanent incisors: Primary teeth are upright but permanent teeth incline to the labial surface thus decreasing the inter-incisal angle from about 150° in the deciduous dentition to 123° in the permanent dentition (Fig. 11). This increases the arch perimeter.

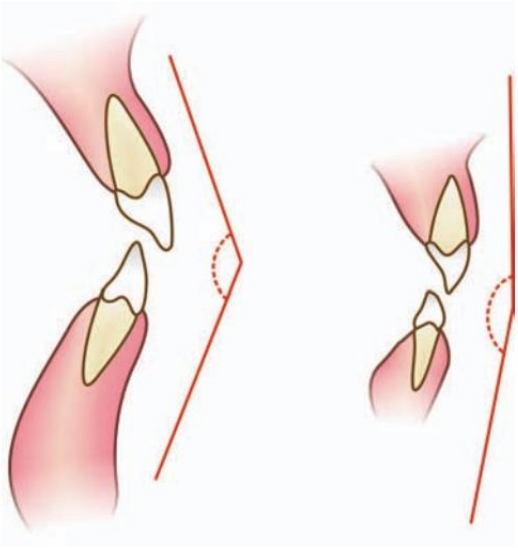


Fig. 11; Comparison of the angulation of the permanent and primary teeth