

## Development of dental arch and occlusion

### DECIDUOUS DENTITION PHASE

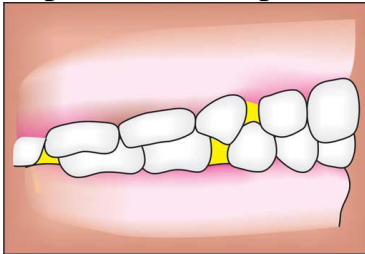
The establishment of the primary dentition is usually around 3 years of age when the roots of second primary molars complete their development, and to last until about 6 years of age when the first permanent tooth begins to erupt. From 3-4 years of age; the dental arch is relatively stable and changes very slightly. From 5-6 years of age, the size of the dental arch begins to change due to eruptive force of the first permanent molar.

### Characteristic Features

The characteristic features of deciduous dentition period are as follows:

#### *Spaces in the Primary Dentition*

It is very common to find physiological spaces in the primary dentition, with the most prevalent spaces mesial to the primary canine in maxilla and distal to the primary canine in mandible. These spaces are called **the primate spaces** on anthropoid spaces which are helpful in canine positioning and relationship with opposing arches.



The other spaces in primary dentition are called **the developmental spaces** which play an important role in the development of permanent dentition. Some children do not have such physiological spaces thereby referred to as closed space or non-spaced dentition. Such dentition is highly prone to malocclusion during the development of permanent dentition.



#### *Shape of Dental Arch*

In deciduous dentition, the dental arch are wider and almost in wide 'U' shape with spaces between teeth visible.

#### *Other Features*

Other characteristic features of deciduous dentition are:

- i. Deep bite
- ii. Relatively flat curve of spee
- iii. Shallow cuspal interdigitation, etc

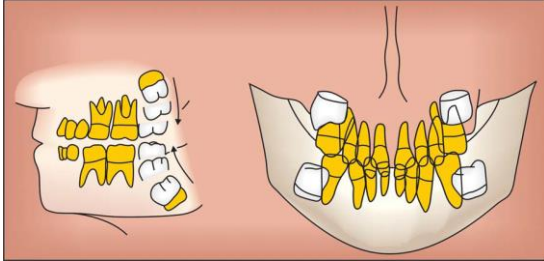
## MIXED DENTITION PHASE

Mixed dentition period can be classified into following three periods:

### i. First transitional period

#### a. Eruption of first molar.

During this process, any unusual spaces created by the carious/traumatic destruction of the tooth crown and/or premature loss of the primary teeth will result in the mesial shift of the first molar in various ways due to presence of physiological spaces in primary dentition.



#### b. Exchange of Incisors

- ❖ Before and after the eruption of the first permanent molars, the primary incisors begin to exchange with the permanent incisors, starting from lower central incisors.
- ❖ The total sum of mesiodistal width of four permanent incisors is larger than that of primary incisors by about 7 mm in maxilla, and by about 5 mm in the mandible which is termed as incisal liability.
- ❖ The regulatory factors controlling the arrangement of the four permanent incisors is as follows:

i. Utilization of the physiologic spaces that exists in the primary dentition.

ii. Increase in the intercanine width.

iii. Increase of anterior length in the dental arch will provide space to accommodate the larger permanent incisors.

The permanent incisors erupt labially about 2-3 mm from the location of primary incisors.

iv. Both maxillary and mandibular permanent incisors show labial inclination much more than primary incisors making the permanent dental arch circumference wider for the arrangement of larger permanent incisor.

#### ii. Intertransitional period.

It is a relatively lag phase with no active tooth movements to occur. The dental arches are comprised of both primary and permanent teeth.

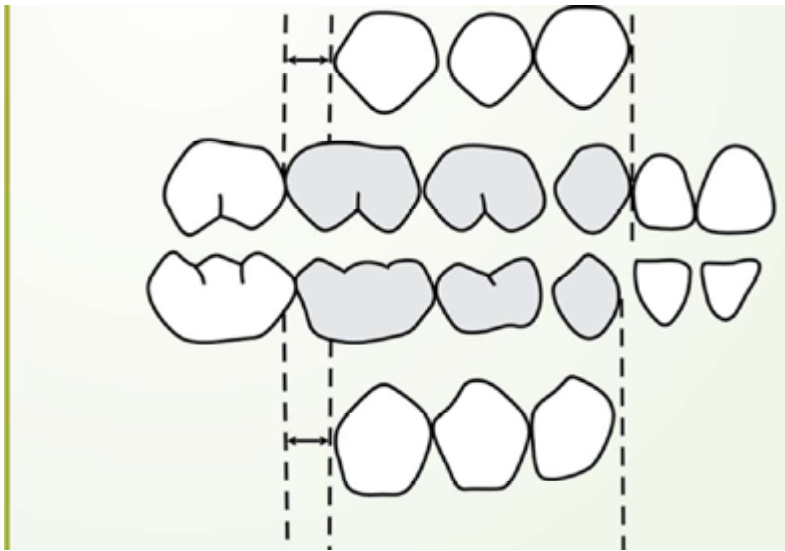
#### iii. Second transitional period.

##### a. Exchange of canines and premolar.

The space available for the canine and premolars is limited as the mesial surface of the first permanent molar forms its distal limit and the distal surface of the permanent lateral incisor forms its mesial limit.

To allow easy and noncomplicated exchange of lateral teeth following factors are necessary.

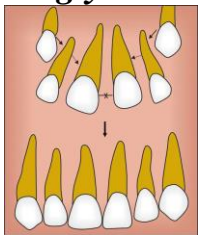
**1- Leeway space :** The sum of the mesiodistal widths of the upper buccal deciduous teeth according to Black is 22.5 mm. The total for permanent teeth is 21.6 mm; leaving a difference of 0.9 mm that is available for mesial molar movement on each side. In lower arch the corresponding deciduous total is 22.6 mm; whereas the total mesiodistal width of permanent teeth is only 20.9 mm, leaving a difference of 1.7 mm. Generally Mesiodistal width of permanent teeth is smaller than that of the primary teeth by about 1.8 mm (both the sides) in maxilla and 3.4 mm (both the sides) in mandible. This extra space that is available in the final transition from primary to secondary dentitions is termed as '**Leewa space**'.



When one observes the size of each lateral teeth, the permanent canine is larger than the primary canine, the first premolar is as large as the primary first molar and second premolar is smaller than second primary molar.

Therefore, although an exchange of the lateral teeth may be carried out smoothly, there is crowding as each tooth is exchanged which is transient.

**2-Ugly duckling stage :**

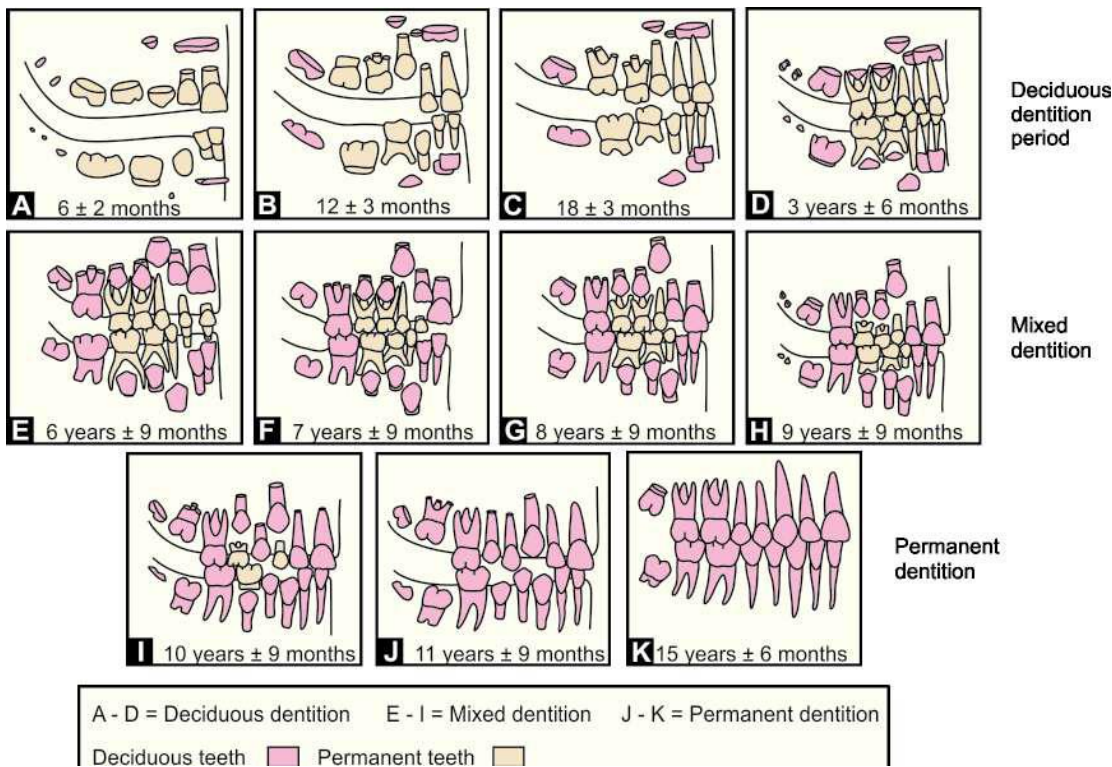


The ugly duckling stage is also termed as broadbent phenomenon; named after the scientist who explained this stage. It is a transient stage; referred to as a self correcting anomaly that occurs in children of 8-9 years age in the maxillary incisor region; during the eruption of permanent maxillary canines.

Initially there is midline diastema between the permanent incisors and spacing between the laterals; as the developing permanent canines erupt, they displace the roots of the laterals mesially resulting in transmitting of the force onto tooth of the central incisors which also show mesial displacement thereby closing the diastema between maxillary permanent incisors.

**b.Eruption of the Second Permanent Molar**

After the exchange of lateral teeth is completed and the dental arch upto the first molar is established, the second permanent molars begin to erupt. With the eruption of second permanent molar, the arch circumference may become shorter than that of the primary arch by utilization of the Leeway space.



## ARCH-LENGTH ANALYSIS

**Nance Analysis.** Nance concluded, as a result of comprehensive studies,

1. the length of the dental arch from the mesial surface of one mandibular first permanent molar to the mesial surface of the corresponding tooth on the opposite side is always shortened during the transition from the mixed to the permanent dentition'
2. in the average patient's mandibular arch a leeway of 1.7 mm per side exists between the combined mesiodistal widths of the primary mandibular canine and first and second primary molars and the mesiodistal widths of the corresponding permanent teeth, with the primary teeth being larger.
3. This difference in the total mesiodistal width of the corresponding three primary teeth in the maxillary arch compared with the width of the three permanent teeth that succeed them is only 0.9 mm per side.

Currently the Nance arch-length analysis is seldom used, partly because the involved procedures for this analysis require a complete set of periapical radiographs.

The clinical reliability of other analyses that do not use radiographs is sufficient for determining major arch-length inadequacies.

### **Moyers Mixed Dentition Analysis.**

#### **Advantages:**

1. It can be completed in the mouth as well as on casts,
2. it may be used for both arches.'
3. The analysis is based on a correlation of tooth size; one may measure a tooth or a group of teeth and predict accurately the size of the other teeth in the same mouth.
4. The mandibular incisors, because they erupt early in the mixed dentition and may be measured accurately, have been chosen for measurement to predict the size of the upper, as well as the lower, posterior teeth.

### **Tanaka and Johnston Analysis.**

1. The Tanaka and Johnston method of arch-length analysis is a variation of Moyers' analysis except that a prediction table is not needed.'
2. The sum of the widths of the mandibular permanent incisors is measured and divided by 2.
3. For the lower arch, 10.5 mm is added to the result
4. for the upper arch, 11 mm is added to the result to obtain the total estimated widths of the canines and premolars. For example, if the width of the lower incisors is 23 mm, divide by 2 and add 10.5 mm for the lower arch. The result is 22 mm compared with 22.2 mm obtained from Moyers' table.
5. One can then take these tooth mass predictions and compare them with the total measured arch length and obtain any inadequacies in the arch length.

### **Bolton analysis.**

1. This analysis addresses tooth mass discrepancies between the maxillary and mandibular arches.
2. It can be used to compare the sum of the mesiodistal widths of the 12 maxillary teeth with that of the 12 mandibular teeth, first molar to first molar, and to compare the 6 maxillary teeth with the 6 mandibular teeth, canine to canine.
3. The Bolton analysis ratio is as follows: (Sum mandibular)/(Sum maxillary) x 100 = Tooth mass ratio For the overall ratio (12 teeth versus 12 teeth), the mean is 91.3 ( $\pm 1.91$ )%. For the anterior ratio (6 teeth versus 6 teeth), the mean is 77.2 ( $\pm 1.65$ )%.
4. When a significant discrepancy with these ratios is noted, the clinician must assess where the tooth mass problem is located and decide on the best method to resolve it.