# *DEVELOPMENT OF OCCLUSION*

# CONTENTS

- Introduction
- Factors affecting occlusion
- Periods of occlusal development
- Pre dental relationship
- Deciduous dentition
- Mixed dentition
- Permanent dentition
- Transitional malocclusions
- Conclusion

- **INTRODUCTION –**
- **The term occlusion is derived from the Latin Word “Occlusio” defined as the relationship between all the components of the masticatory system in normal function, dysfunction and parafunction (Foster).**
- **An ideal occlusion is the perfect inter digitations of the upper and lower teeth, which is a result of developmental process consistency of main 3 events.**
- **Jaw growth**
- **Tooth formation**
- **Tooth eruption**
- **Although the inhabitations between the teeth essentially established in childhood, it changes to same extent throughout life. Therefore occlusion is regarded as dynamic rather than static.**

# Factors affecting the development of occlusion -

Factors responsible

- General
- Local

# General factors

Skeletal factors

- The size, shape and relative positions of the upper and lower jaws

Muscle factors

- The form and functions of the muscles which surround the teeth ie, the muscles of the lips, cheeks and tongue.

Dental factors

- The size of the dentition with respect to the size of the jaw.

# Local factors

- Aberrant development position of teeth
- The presence of supernumerary teeth.
- Hypodentia
- Effect of certain habit activities
- Localized soft tissue anomalies – the labial frenum.

# Periods of occlusal development

- The occlusion of the teeth may be divided into the following developmental periods. (So for convenience of understand)
- Pre dental relationship (neonates mouth)
- The deciduous dentition
- The mixed dentition
- The permanent dentition

# The mouth of the neonate

- At birth, the alveolar processes are covered by gum pads, which soon are segmented to indicate the site of developing teeth. The basic form of the arches is determined in intra uterine life.
- The maxillary arch is horse shoe shaped and the gum pads tend to extend buccally and labially beyond those in the mandible, furthermore, (so producing uniform overjet), the mandibular arch is posterior to the maxillary arch when the gum pads contact.

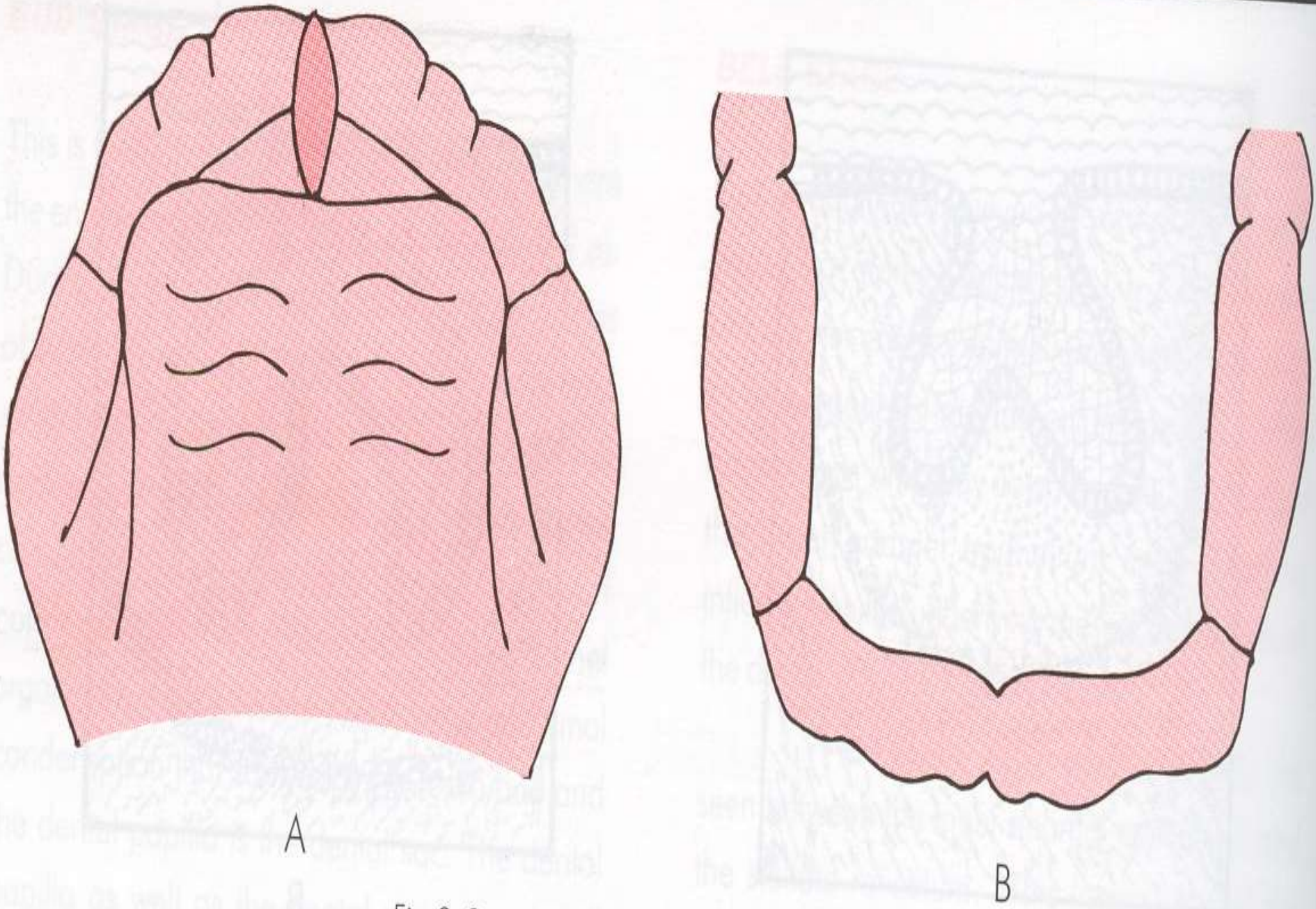



Fig 3 Gum pads (A) Maxillary (B) Mandibular

# Neonatal jaw relationship

- At birth there is such a variability in the relationship of the upper and lower gum pads, that neonate relationship cannot be used as a diagnostic criteria for reliable predictions of subsequent occlusion in primary dentition.

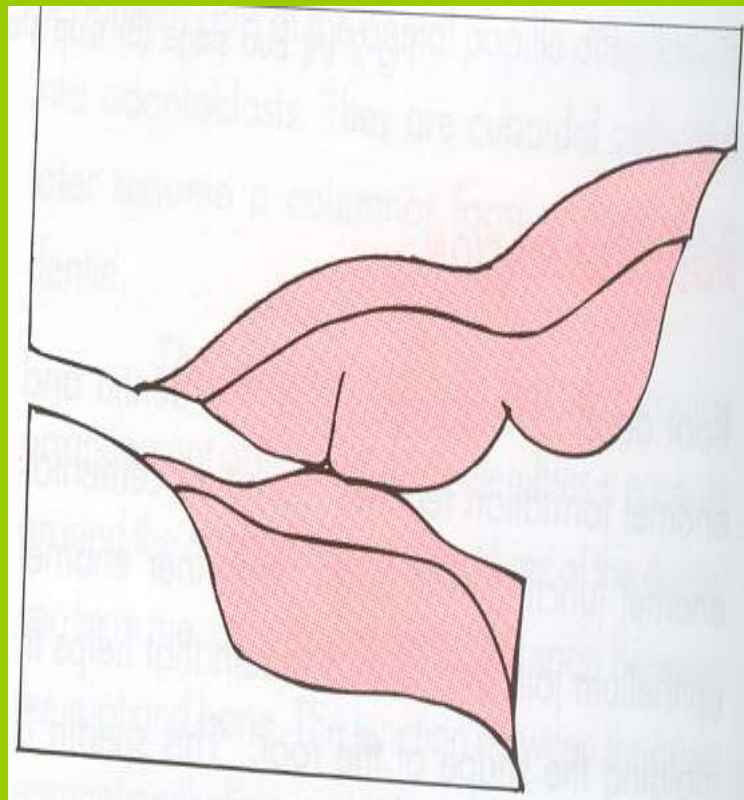


Fig 4 Relation between upper and lower gum pads at birth

# Precociously erupted primary teeth

- Occasionally a child is born with teeth already present in the mouth. Natal (Present at birth) neonatal / erupted during 1st month) and pre-erupted (Erupted during the 2nd and 3rd months) teeth are almost always mandibular incisor which frequently display enamel hypoplasia. There are familial tendencies for such teeth.

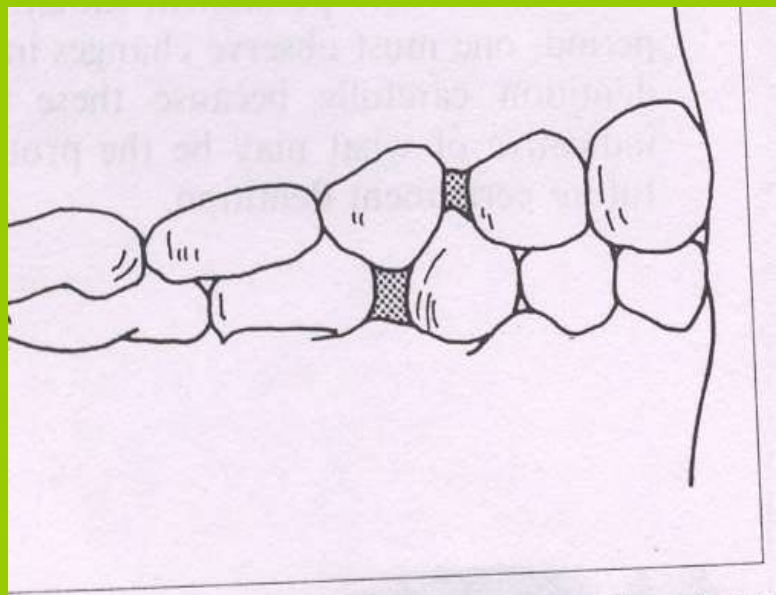
# The primary teeth and occlusion

- At birth, the dental arches are small with a subsequent crowding of tooth germs which are within the jaw bone. This is overcome by increased jaw growth and the buccal placement of tooth germs.

| | Hard Tissue Formation Begins | Amount of Enamel | Enamel Completed Formed at Birth | Eruption | Root Completed |
|---|---|---|---|---|---|
| **PRIMARY DENTITION** | | | | | |
| **Maxillary** | | | | | |
| Central incisor | 4 mos. in utero | Five sixths | 1 1/2 mos | 7 1/2 mos | 1 1/2 Yrs |
| Lateral incisor | 4 1/2 mos. in utero | Two thirds | 2 1/2 mos | 9 mos | 2 Yrs |
| Cuspid | 5 mos. in utero | One third | 9 mos | 18 mos | 3 1/4 Yrs |
| First molar | 5 mos. in utero | Cusps united | 6 mos | 14 mos | 2 1/2 Yrs |
| Second molar | 6 mos. in utero | Cusp tips still isolated | 11 mos | 24 mos | 3 Yrs |
| **Mandibular** | | | | | |
| Central incisor | 4 1/2 mos. in utero | Three fifths | 2 1/2 mos | 6 mos | 1 1/2 Yrs |
| Lateral incisor | 4 1/2 mos. in utero | Three fifths | 3 mos | 7 mos | 1 1/2 Yrs |
| Cuspid | 5 mos. in utero | One third | 9 mos | 16 mos | 3 1/4 Yrs |
| First molar | 5 mos. in utero | Cusps united | 5 1/2 mos | 12 mos | 2 1/4 Yrs |
| Second molar | 6 mos. in utero | Cusp tips still isolated | 10 mos | 20 mos | 3 Yrs |

## Physiologic / development spaces

- These are present between the primary teeth and play an important role in the normal development of the permanent dentition.
- The total space present may varying from 0-8 mm with the average of 4 mm in the maxillary arch and 1-7 mm with the average of 3mm in the mandibular arch.



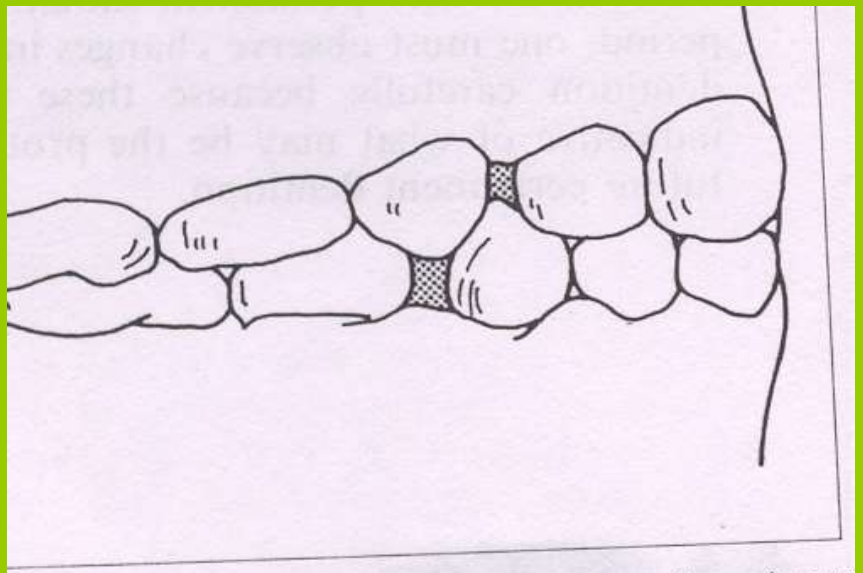
Primate space. This is the space between the primary canine and first primary molar in the mandibular arch and between the primary lateral incisor and canine in the maxillary arch.

## Non-spaced dentition

- Primary teeth are present with out any spaces in between the teeth the lack of space, may be due to the narrowness of the dental arches or teeth are under than usual.  This type of dentition usually indicates and crowding its developing permanent dentition but it is not always the case. It may depend on the individual's growth of jaws.

# Primates spaces / Antropoid space

- it is the space present between the upper deciduous lateral incisor and canine and between lower canine and first molar



Primate space. This is the space between the primary canine and first primary molar in the mandibular arch and between the primary lateral incisor and canine in the maxillary arch.

# Occlusal relationship

- Primary dentition develops quite independently of other morphologic processes class, there is little relationship between 1o tooth development and skeletal maturation. Thus dentition is complete often the eruption of the 2nd primary molar, indicating that location for permanent teeth in future has been determined at this stage.

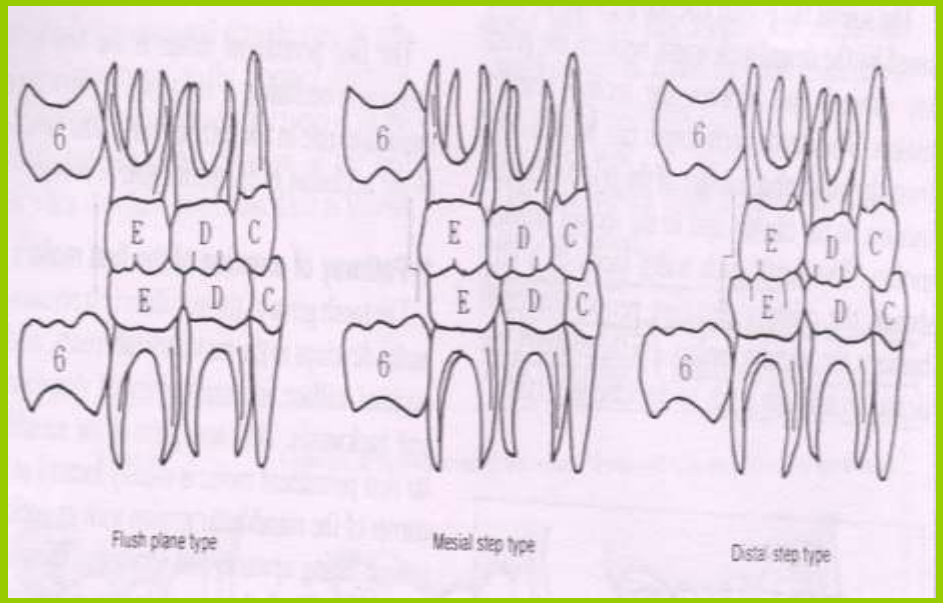
## Primary molar relationships.

- **The relationship of the distal surfaces of the maxillary and mandibular 2nd primary molars is one of the factors that influence the future occlusion of the permanent dentition. The posterior primary teeth occlude so that the mandibular cusp articulates first ahead of the corresponding maxillary cusp.**

- The mandibular first molar occludes between the disto occlusal aspect of the 1st primary molar and the mesio-occlusal aspect of the 2nd molar in the mandibular. The mesiolingual cusps of the maxillary molar occludes in the central fossa of the lower mucus.
- The mesio distal relationship between the distal surfaces of the upper and lower 2nd primary molars usually can be classified into 3 types.

- **Flush terminal / vertical plane**
- The distal surface of the upper and lower teeth are in a straight plane and thus situated in the same vertical plane, usually it is favourable relationships to guide the permanent molars.
- **ii. Mesial step type**
- The distal surfaces of the lower molar is more mesial than that of the upper. Invariably it is favourable to guide the permanent molars into Class I relationship.

- **iii. Distal step type**
- The distal surfaces of the lower molar is more distal to that of the upper. This relationship is unfavourable as its guides the permanent molars



- **. Anterior teeth relationship**

- **Overbite**
- It is the distance which the incisal edges of the maxillary incisors overlap vertically past the incisal edge of the mandibular incisors. The average overbite in the 1o dentition is 2 mm and is sometimes expressed interfering of % of mandibular incisors crowns covered.

- **Overjet :** It is the horizontal distance between the lingual aspect of the maxillary incisors and the labial aspect of the mandibular incisors which the teeth are in centric occlusion.
- The average in the primary dentition is 1-2 mm with a normal range of 2-6 mm.

- **V. Canine relationship**
- The relationship of the maxillary and mandibular deciduous canines is one of the most stable in 1o dentition.
- It is classified as class I when mandibular canine interdigitates in embrasures between the maxillary lateral and canine and class II when mandibular canines interdigitate distal to embrasure.

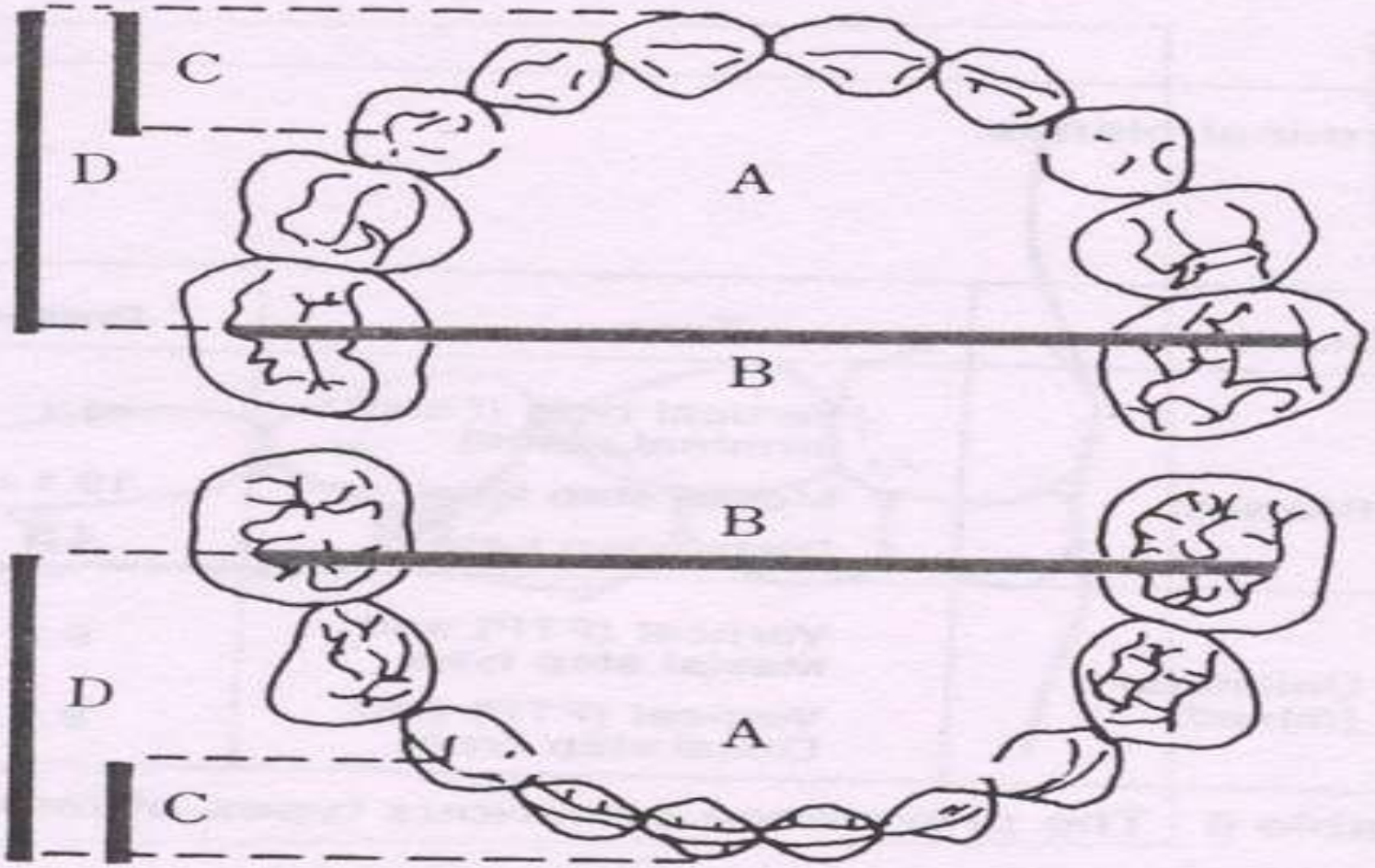
- **Arch dimensions**
- The size of primary dental arch can be measured by the dental arch width between the primary canines and between the 2nd primary molars.

- **Arch length and circumference**
- A small amount of 4 in arch length takes place from the eruption of the 2nd molars until the eruption of the 1st permanent molars due to the mesial migration of the 2nd primary molars, the arch length can be shortened due to interproximal caries.
- The dental arch length can be measured from the most labial surface of the primary central incisors to the canines to the 2nd primary molars.

- **Arch circumference**
- Is determined by measuring the length of the curved the passing over the buccal cusps of the incisal edges of the teeth from the distal surface of the primary 2nd molar around the arch to the distal surface of the other primary molar.

- **Arch width**
- Both maxillary and mandibular arches increase in width by growing posteriorly to accommodate the eruption of permanent molars.

- **Arch height**
- Increase in the height of the alveolar bone takes place as it's grows with time.
- There is little or no increase in the arch height during the period of primary dentition.




A : Inter-canine width
B : Inter-molar width
C : Anterior arch length
D : Total arch length

g. 8 Measuring points to determine the width and length o
the primary dental arch.

## Disorders of primary occlusion

- The prevalence of all malocclusions varies greatly with the population studied and this method of rotation. Ethnic and cultural features are important not only for the obvious skeletal differences but because some cultures show much less thumb sucking and other oral habits than others, thus having an effect on the % of children displaying posterior cross bites, open bites and Class II mal-occlusions.

- Boys tend to have more class II and Class III molar relationships in the primary dentition then girls and the prevalence of class II malocclusion decreases during the primary dentition period.

- Bruxism in the primary dentition is a special problem which may be termed as functional malocclusion. It is almost always unconscious being manifest by occasional or habitual grinding or clenching of the teeth and is not necessarily pathogenic.

# THE MIXED DENTITION PERIOD

- The period during which both the primary and permanent teeth are in the mouth together is known as mixed dentition. The permanent teeth erupting in the place of the previous deciduous teeth are the successional teeth and those erupting posteriorly are called the accessional teeth.

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# Phases of mixed dentition

- The first transitional period
- Emergency of the 1st permanent molars
- Incisor transition
- Establishment of occlusion
- Inter transitional period
- Containing both sets of dentition
- Four permanent incisors, left and right first permanent molars.
- Deciduous canines and deciduous 1st and 2nd molars.
- Second transitional period
- Emergencies of bicuspids, cuspids and 2nd permanent molars.
- Establishment of occlusion

# First Transitional period

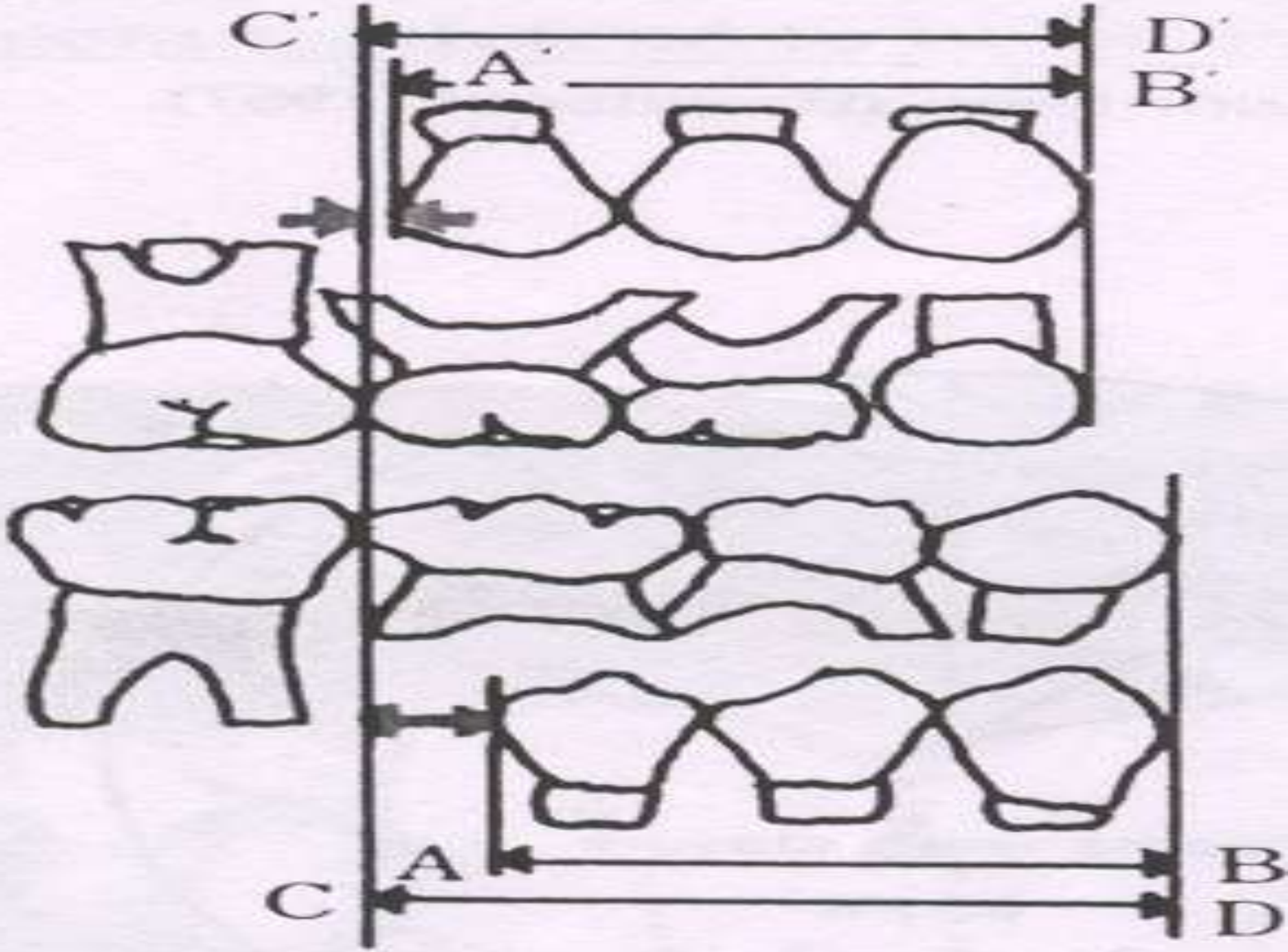
- By the time of the 1st permanent molar eruption any initial space between the deciduous molars and canines will have generally diminished and disappeared.
- In both the jaws, the first permanent molar erupt more or less in a perpendicular orientation to the occlusal plane
- The anteroposterior relation between the 2 opposing molars often eruption depends on
- The position primarily occupied within the jaws.
- The sagital relation between the maxilla and mandible.
- Ratios of the mesiodistal crown dimensions of the upper and lower deciduous teeth.

- Ideally, the eruption of the permanent molars into a class I relationships is desired single the flush terminal plane relationship is more common in deciduous dentition, it is more common for the permanent molar to erupt into end on end relationship. The desired class I relationship is established by the following ways.
- Terminal plane
- Presence and absence of space.

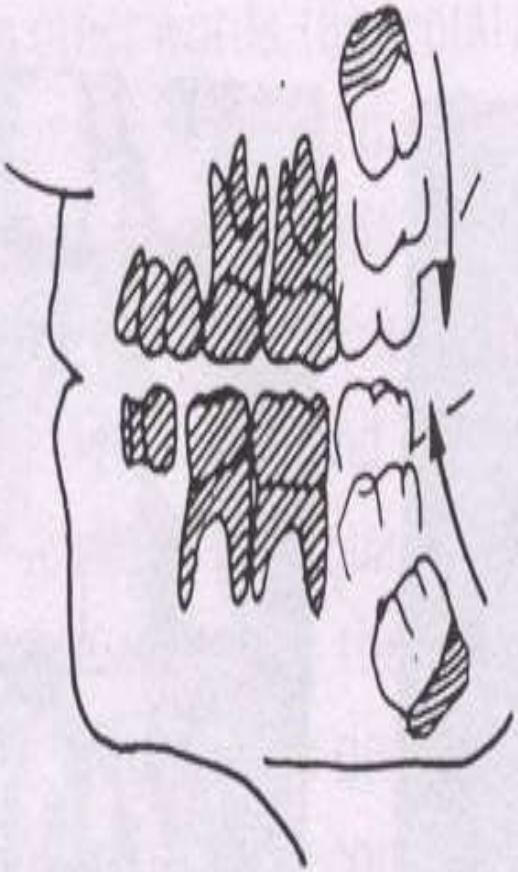
- a. Early mesial shift
- If the deciduous dentition is spaced dentition with flush terminal relationship of 2nd deciduous molars the eruptive force of the permanent molars causes and closing of any existing spaces between the primary molars of primate space efficiency causing a in arch length.

b. Late mesial shift.

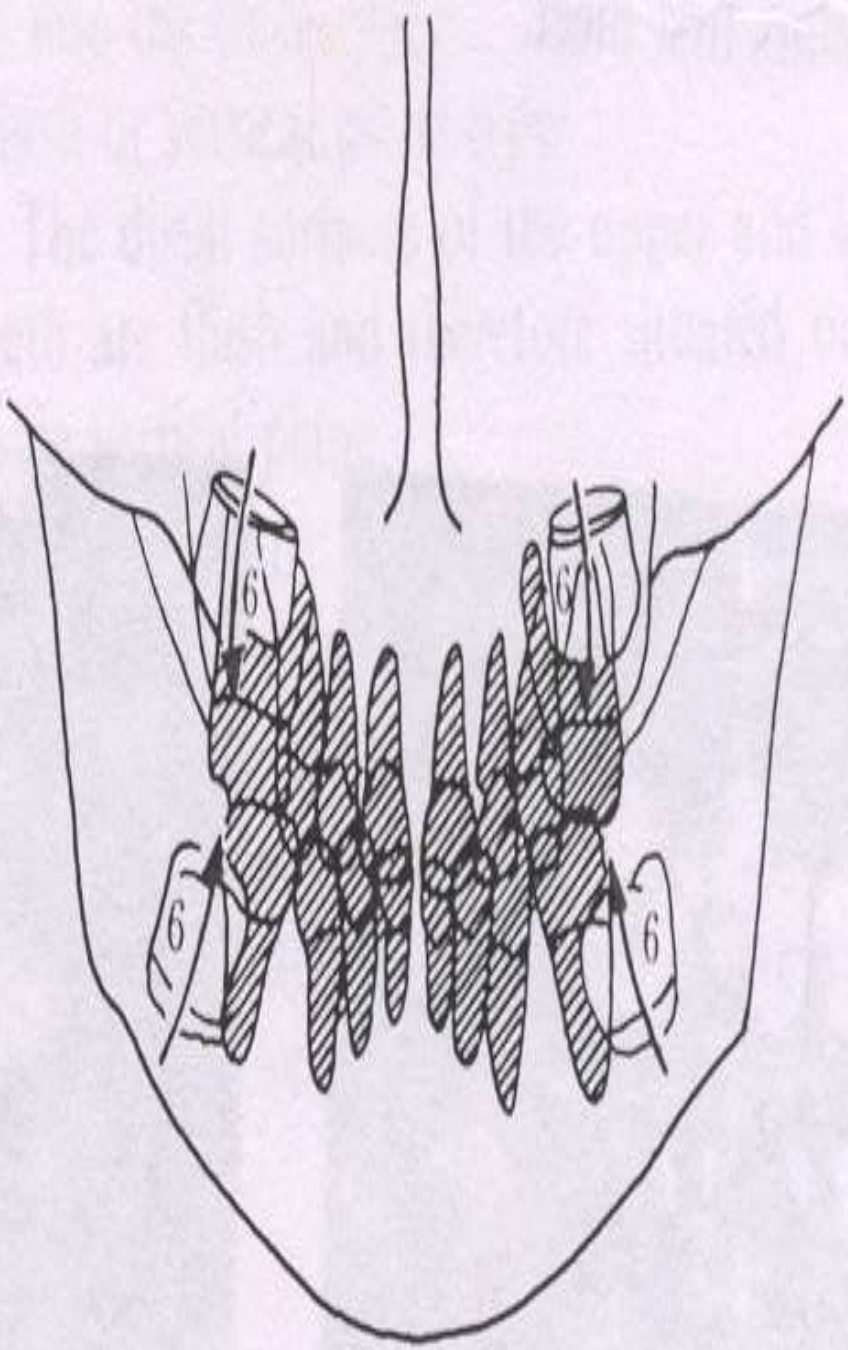
- When no space exists, the erupting 1st permanent molar is not able to close spaces. In these case when the primary molar exfoliates the permanent molar migrates mesially to use up the lewway space (the difference between the mesio distal width of the primary canine, first and 2nd molar and their permanent successors. This averages 1.8 mm in the maxilla and 3.4 mm in the mandible.


C'
D'
A'
B'
A
B
C
D

- c. Primary molar guidance of permanent dentition
- The primary 2nd molar relationship can give due to the eventual permanent molar relationship. if the deciduous arches terminate in a mesial step, the permanent molars may erupt directly into a normal angles class I occlusion. A definite distal step guides the molars into distal relationship which generally does not improve with age, it leads to deterioration .



Mesio-distal direction

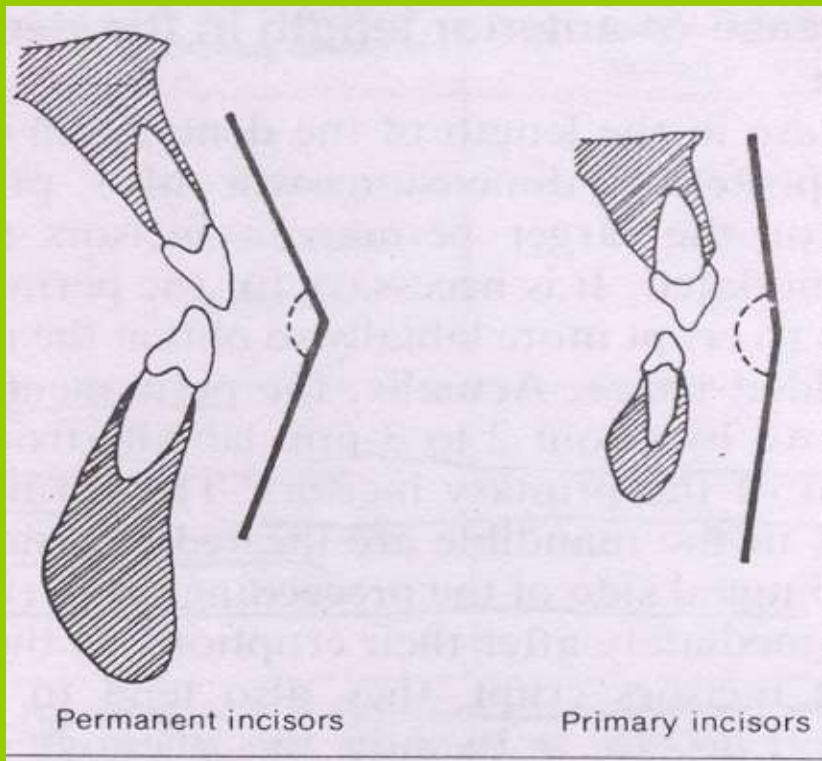



Bucco-lingual direction

- **Incisal transition**
- The period of transition (aged 6 ½ to 8 ½ ) in critical for the development of the dentition.
- **a. Interdental spacing of primary incisors**
- Inter dental spaces average 4 mm in the maxillary arch and 3mm in the mandibular arch lack of interdental spacing must be considered a serious handicap towards normal incisor alignment .
- **b. Intercanine arch width growth**
- Only negligible amounts of growth occur from 3 years – 6-7 years when the permanent mandibular incisors begins the erupt. A notable amount of growth occurs with the eruption of the incisors and canines.

| Sex | Dental arch | Width increase between 2-18 years |
|---|---|---|
| Males | Maxillary | 6 mm |
| | Mandibular | 4 mm |
| Females | Maxillary | 4.5 mm |
| | Mandibular | 4 mm |

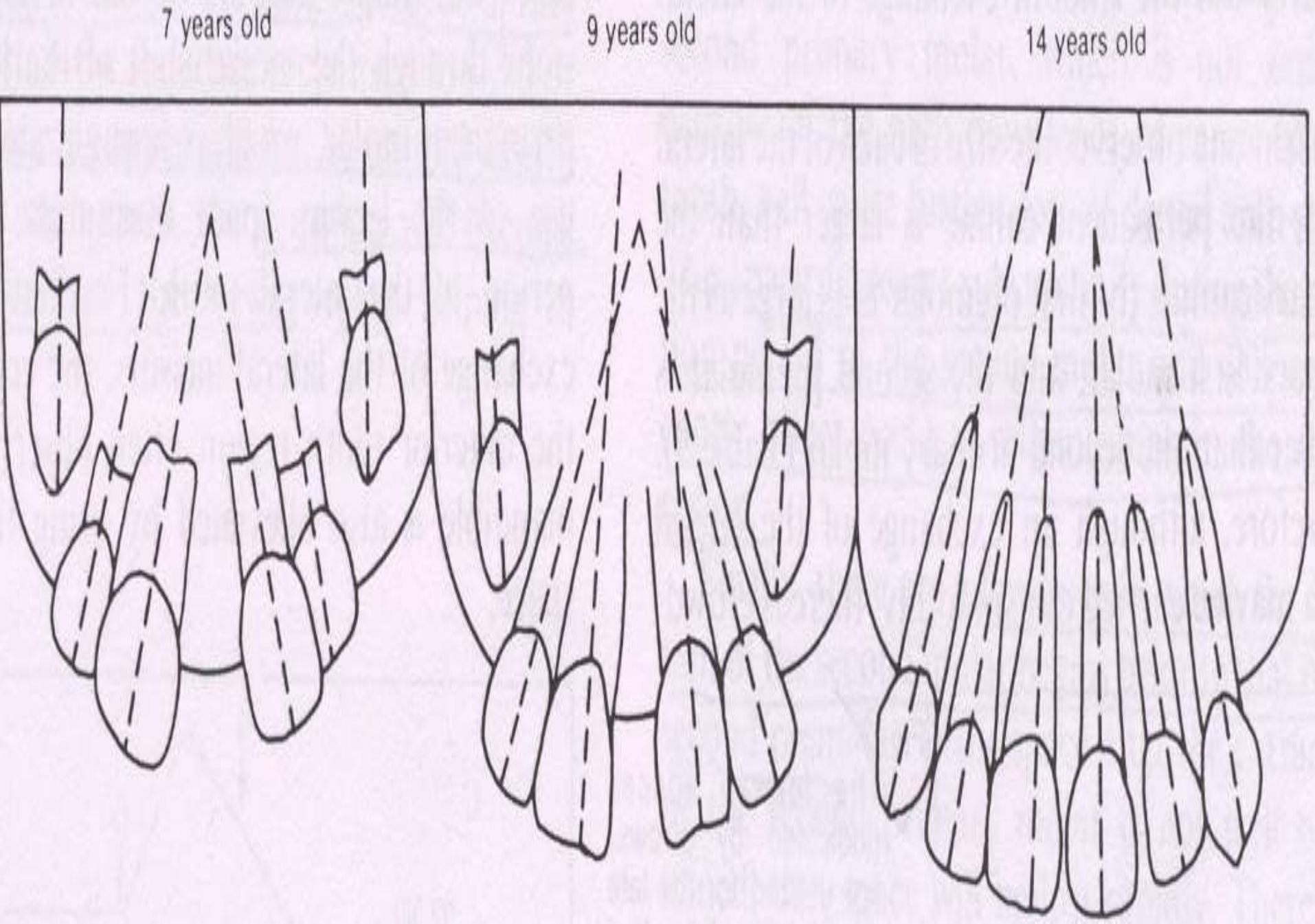
- **Inter canine arch length increase**
- When the permanent incisors erupt, they assume a some what more anteriorly inclined position (labial inclination) than the deciduous incisors. This position of the incisors averages 2.3 mm and results in an increase in intercanine arch length of approximate 3mm without any charge in intercanine width.



Changes of the incisal axial inclination.

- The inter incisal angles between the maxillary and mandibular incisors are about 153$^{o}$ in primary dentition whereas it is about 123$^{o}$ in permanent dentition which makes permanent dental arch circumference wider. The sum total of the mesiodistal width of the permanent lateral incisors is generally smaller than that of the primary lateral incisors by about 1mm in the maxilla and 3 mm in the mandible.

- **Broadbent phenomenon**
- School children tend to look unusual during the exchange from the incisors, especially in the upper arch when the permanent incisors erupt. These appear to be much larger compared with the 1o teeth, with their longitudinal axes found out like an inverse V-Because of these pressure of permanent erupting canines on the developing roots of the lateral incisors, the crown of the erupting incisors flare laterally producing a diaestema. The transitional malalignment during the exchange period of the upper anterior is called the ‘ugly duckling’stage. (Broadbent in 1937). This phenomenon is self correcting and normally the incisors gradually straighten with the eruption of the lateral incisors and canines.


7 years old
9 years old
14 years old

- **Inter Transitional Period**

- Time taste for 1.5 years, associated differences in height and length of clinical crowns of the corresponding left and right teeth are made up.
- Under the influence of the tongue, the mandibular lateral incisors attain the proper sites within the dental arch and then initially lingual location is eliminated. Small rotations are corrected by the pressure existed by the tongue and lips of the spatial conditions in the dental arch permit these movements.
- These are wearing of deciduous teeth with attributes of the cusp tips and occlusal morphology by approaching that of a place.
-

- **Second transitional period**
- At around 9-10 years of age, the 2nd transilateral period starts with shedding of the posterior teeth. The alignment of the erupting permanent teeth depends a lot on the order of exchange of lateral teeth which takes about 1 ½ years to complete.
- Transition from the ugly drinking to a mature stage of dentition in called a prepubertal period. This is in correlation with the maturation of the child as a whole.

- During this period, the child tends to lose the soundness of childhood and advances noticeably towards adolescence.
- The most common sequence of eruption of permanent lateral teeth’on the maxilla in 4-3-5 and in the mandible in 3-4-5.Because permanent canine is larger than the primary canine, crowding is very common after its eruption

- **Clinical considerations**

From a clinical point of view there are two way important aspects to the mixed dentition

- The utilization of the arch permiters (arch circumference)
- The adoptive changes in occlusion that occurs during the transition from are dentition to the other.
- The alveolar processes are one of the most actively adaptable areas of bone growth during the period of transition between the dentition.
- Therefore, it is an ideal time for major orthodontic interventions.

- **Self correcting anomalies**
- **Definition**
- Anomaly is defined as the marked duration from the normal.
- Self correcting anomalies are the anomalies which arise in the child's developing dentition during the period of transition from the gum pade stage to the areas and permanent period and get corrected on their own without any dental treatment.

- 1. Pre dentition period
- a. Retrognathic mandible Corrects with differentiated and forward growth of the mandible
- b. Anterior open bite Eruption of primary incisors
- c. Infantile swallowing pattern During the first year of life with introduction of solid foods in development.

- **II. Primary dentition**
- 1. Anterior deep bite Correct with Eruption of deciduous molars Attrition of incisal edges
- 2. Flush terminal plane Forward and downward growth of the mandible.Eruption of the first permanent molar (Late slight) leeway space
- 3.Spacing Eruption of 1st permanent molars
- 4. Edge to edge (Due to attrition )Eruption of permanent incisors.

- **III. Mixed dentition**
- 1. Anterior deep bite Proproceptive response condition of patient (with the eruption of the 1st permanent molars and premature contact of the pad of tissue oralying them as natural bite openes.)2. Mandibular anterior crowding Tongue pressure Increase in intercanine width 3. Ugly drinking stage Maxillary canine eruption 4.End to end relationship With eruption of the just permanent molar Late normal shift in the non spaced dentition
- **IV. Permanent dentition**
- 1. Over jet and overbite Decrease with eruption of all permanent molars Differential growth of mandible

# Permanent dentition

- Overjet and over bite - decrease with eruption of all permanent molars. Differential growth of mandible.
- **Clinical considerations**
- Self correcting anomalies are part of developing dentition and should not be considered as any development or pathological abnormality.
- **Exchange of canines**
- After the exchange of lateral teeth has been completed, the dental arch upto the 1st molar is established the 2nd molars being to eruption. The dental arch length is reduced first prior to the eruption of the 2nd molar by the mesial force.
- It is quite possible that eruption of the 2nd molar ma accentuate the crowding which was already present in the dentition.

# Conclusion

So, development of occlusion is not static but dynamic process which has got both genetic and environmental influence.The influence of environment starts from pre natal life in utero, itself.

- And as child is birth, the development of occlusion takes place with progressing year initiates at faster rate and each stage has its own importance and we as pedodontist showed properly monitor the development of occlusion of each child, any carious tooth, early loss of tooth should be treated so that there should not be any space loss and helping in development of  normal occlusion.