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# Too much too soon, rather than in too little too late: Orthodontic in mixed dentition

**Dr. Yashi Andley, Dr. Bhavna Gupta Saraf, Dr. Neha Sheoran and Dr. Nisha**

**Abstract**
When it comes to treatment planning in orthodontics "Timing is everything". It is suggested that almost all types of malocclusion could be benefited from early treatment. The aim of "early" orthodontic treatment is to correct existing or developing skeletal, dentoalveolar, and muscular imbalances to improve the orofacial environment before the permanent teeth eruption is complete. The "epitome of dynamic orthodontic approach" is the beginning of the treatment in the deciduous dentition. It is here we have growth to assist us, hard tissues are highly responsive to forces applied and soft tissue shows a higher degree of adaptability, thereby enhancing the stability of results. Early intervention can simplify or eliminate the need for later treatment. Mixed dentition treatment also may ensure normal development of the teeth and jaws. The functional improvement coupled with the psychological benefit gives a significant advantage for treating potentially challenging mixed dentition problems.

**Keywords:** Orthodontic treatment, mixed dentition, correction of malocclusion

## 1. Introduction
Dental neglect of primary dentition is principal cause of malocclusion in the permanent dentition. Mixed dentition period is period of dental development starting with eruption of first permanent molar and ending with complete replacement of deciduous teeth. Average period is 6-8 years and coincides with rapid growth of craniofacial skeleton [1].
Primary aim of mixed dentition treatment are to eliminate functional interference, correct dental arch irregularities, and occlusal relation abnormalities and to intercept or correct malocclusions that would otherwise become progressively more complex in the permanent dentition or result in skeletal anomalies. Such treatments may be described as preventive or interceptive [1].

**Some of the factors for early intervention [2]**
- Greater ability to modify skeletal growth;
- improved patient self-esteem and parental satisfaction
- better and more stable result
- less extensive therapy required later;
- minimise potential for iatrogenic tooth damage such as trauma

This review article emphasis that the goal of orthodontic treatment is to get "the achievable normal occlusion which is aesthetically pleasing and functionally stable." Factors which influence orthodontic goal are not only the type of malocclusion, but also mechanotherapy or the type and duration of retention; but timing of treatment is equally important.

## Discussion
Orthodontic intervention in the mixed dentition does not always prevent orthodontic treatment in the permanent dentition; however, there can be significant advantages to early intervention. Identifying certain problems at an early age offers a possibility either to redirect skeletal growth or to improve the occlusal relationship. The main objective of managing orthodontic problems in the mixed dentition stage is to intercept or correct malocclusions that would otherwise become progressively more complex in the permanent dentition or result in skeletal anomalies [3].

According to American association of orthodontists every child must have an orthodontic examination by the age of seven. By then, maxillary and mandibular first molars, lateral incisors and central incisors should have erupted. It has been suggested that almost all types of malocclusion could be benefited from early treatment [3].

**Early treatment presents opportunity to [3]**

- Influence jaw growth in a positive manner
- Harmonize width of the dental arches
- Lower risk of trauma to protruded upper incisors
- Improve airway/speech problems
- Correct harmful oral habits
- Preserve/gain space for erupting permanent teeth
- Improve eruption patterns-less likelihood of impacted permanent teeth
- Improve aesthetics and self-esteem
- Simplify and shorten treatment time for later corrective orthodontics.

Mixed dentition analysis forms an essential part of an orthodontic assessment because it helps to determine amount of space available (whether mandibular or maxillary arch) for accommodation of the incremental permanent teeth, and for the transitional changes occurring in the mixed dentition stage [4].

**Consequently following should be highlighted**

- All transverse alterations should be treated as soon as possible, ideally during mixed dentition
- If transverse alteration is skeletal, treatment should be even earlier, as soon as first upper permanent molars erupt
- If transverse problem is dentoalveolar then treatment can be delayed until permanent dentition, but only while patients are still growing.
- If transverse alteration is accompanied by a vertical or anterior-posterior malocclusion, transverse alteration must be treated first.
- Results must be stabilised with retainers until all the permanent teeth have replaced the deciduous teeth after correcting transverse malocclusion at an early age,

Permanent teeth erupt on average beginning at 6 years of age (lower central incisors, upper and lower first molars) and other than third molars is complete by 12 years of age [8].

**Mixed dentition period is classified into 3 phases [9]**

1. First transitional period = emergence of first permanent molars and exchange of deciduous incisors with permanent incisors.
2. Inter-transitional period = maxillary and mandibular arches consists of sets of deciduous and permanent teeth. Between the permanent incisors and first permanent molars are deciduous molars and canines. This is relatively stable phase and no change occurs.
3. Second transitional period = replacement of deciduous molars and canine by premolars and permanent Cuspids respectively [9].

Most common eruption sequence is 6-1-2-3-4-5-7 in lower arch and 6-1-2-4-5-3-7 in upper arch [8].

First permanent molars are guided into the dental arch by the distal surface of the second deciduous molars. The mesio-distal relation between the distal surfaces of the upper and **lower second deciduous molars can be of 3 types**

A flush terminal plane (Fig 1).

B Distal step (Fig 2).

C Mesial step (Fig 2).

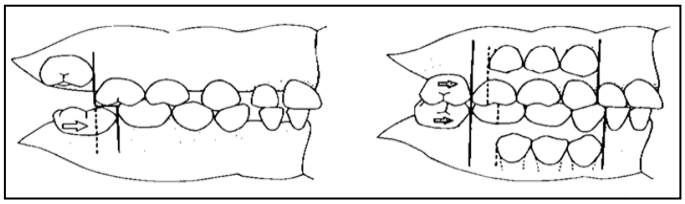
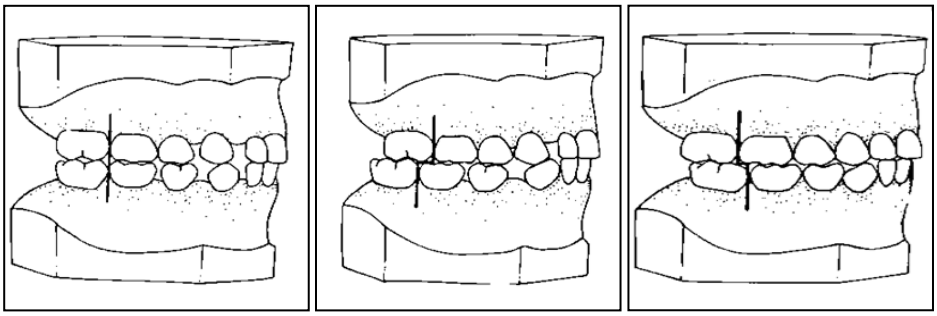


**Fig 1:** Early Shift & Late Shift



Flush terminal plane Distal step terminal plane Mesial step terminal plane

**Fig 2**

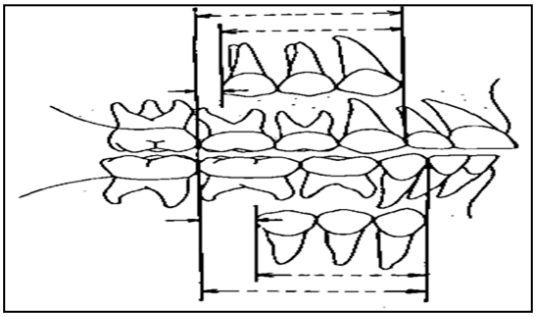


**Fig 3:** Leeway Space of Nance

**Incisal Liability** occurs during the exchange of incisors in which the difference in the amount of space needed for the accommodation of the incisors and amount of space available for this is called **Incisal Liability**. Incisal liability is roughly about 7 mm in maxillary arch and about 5 mm in mandibular arch.

**Incisal liability is overcome by following factors**

1. Utilizing interdental space seen in primary dentition
2. Increase in inter canine width
3. Change in incisor inclination

**Transition from primary incisors to permanent incisors possible because**

1. Interdental spacing of primary teeth if available - Baume Type I [8].
2. Primate spaces – allows incisor transition with less than mean average of 1 to 2 mm [8].
3. Incisor crowding. Larger basal arch size. If not available, much more likely to end up with crowding at above average levels [8].
4. Intercanine arch width during incisor eruption increases and "growth" transition" [8].
5. Increase in lower intercanine width - mean of 2.4 mm. with range of 0 to 5 mm [8].
6. Intercanine arch width stabilizes after incisor eruption is complete at 8 years of age [8].
7. Permanent canines will erupt at same arch width as primary canines occupied [8].
8. Increase in upper intercanine width - mean of 3.0 mm. with range of 0 to 6.5 mm [8].

Another increase of about 2 mm. will occur in maxillary width when canines erupt at age 12 years [8].

Buccal segments undergo transition with eruption in the lower arch of the canines around 10 years of age, eruption of upper and lower first premolars approximating age 11-11.5 years, eruption of upper and lower second premolars at age 11.5-12 years and eruption of upper canines at age 12+ years [8].

**Leeway Space of Nance (Fig 3)**

The combined mesio-distal width of the permanent canine and premolars is usually less than that of the deciduous canines and molars. The surplus space is called leeway space of Nance [9].

The amount of leeway space is greater in the mandibular arch than in the maxillary arch.it is about 1.8mm (0.9 mm on each side of the arch) in the maxillary arch and about 3.4mm (1.7mm on each side of the arch) in the mandibular arch. The excess space available after the exchange of the deciduous molars and canines is utilized for mesial drift of the mandibular molars to establish class I molar relation [9].

Ugly duckling Stage (Fig 4) a self-correcting malocclusion is seen in the maxillary incisor region between 8-9 years of age. This situation is seen during the eruption of the permanent canines. This condition has been described by Broadbent as the ugly duckling stage as children tend to look ugly during this phase of development. This condition usually corrected by itself when the canines erupt and the pressure is transferred from the roots to the coronal area of the incisors [9]. The "Ugly duckling" stage is normal transitional appearance with "splayed" maxillary incisors under influence of eruptive positions of adjacent incisors and canines [8].

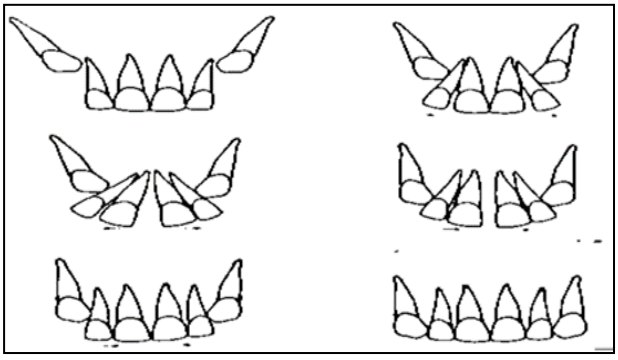


**Fig 4:** Ugly duckling stage

**In the early mixed dentition years after incisor transition, the incisors normally exhibit**

1. On average, 1.6 mm. of lower incisor "crowding", S.D. of ±1 mm. (i.e. slight "crowding" normal) [8].
2. On average, no spacing or crowding in the upper incisor segment (S.D. of ±1 mm.). Overjet ideally is no overjet with incisal contact, range is 0 - 3 mm.
3. Overbite is about 2 mm. or 30 - 50% vertical overlap, two S.D. range is 0 – 5 mm [8].

**Permanent molar transition positioning influenced by [8]**

- Relationship of Primary molar terminal plane.
- As first molars erupt Primary spacing is closed by "early mesial shift".
- The difference in size between primary C-D-E and permanent 3-4-5 teeth (i.e. leeway space) results in "late mesial shift" of first molars when second primary molar exfoliates
- On average, leeway space is +0.9 mm in upper & is +1.7 mm. in lower per quadrant.
- Relative A-P positioning is affected by the Mandibular growth and differential growth.

**Permanent Molar Relationships in the Mixed Dentition**

- Class I (Fig 5)
- End-on Class II (Fig 6)
- Full Class II (Fig 7)
- Class III.

**Fig 5:** Class I

**Fig 6:** CLASS II

**Fig 7:** Full Class II

**Management of the mixed dentition occlusion by**

1. Space supervision
2. Guidance of Eruption
3. Preventive Orthodontics
4. Interceptive Orthodontics

**Goals of Mixed Dentition Management of the Occlusion [8]**

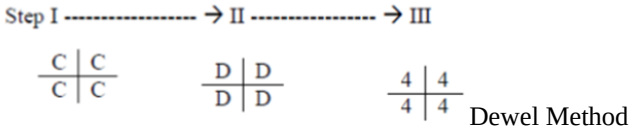
- Incisor integrity: Satisfactory alignment of anterior teeth without significant midline discrepancy, excessive protrusion, lingual malpositioning, open bite or excessive deep bite.
- Development of Dentition without functional problems: Elimination of functional posterior and anterior cross bites, deleterious oral habits and temporomandibular dysfunction (TMD).
- Optimal tooth eruption: Correction of eruption anomalies such as ectopic molars and canines, over-retained primary teeth, delayed permanent tooth eruption, ankylosis, supernumerary teeth.
- Avoiding unnecessary extraction of permanent teeth: Optimal use of leeway space and arch perimeter with symmetrical molar positioned without symptomatic space loss.

**Preventive orthodontic procedures [9]**

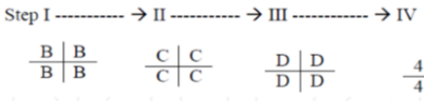
1. Parent education
2. Caries control
3. Care of deciduous dentition
4. Management of ankylosed tooth
5. Maintenance of quadrant wise tooth shedding time table.
6. Check-up for oral habits and habit braking appliance if necessary.
7. Occlusal equilibration if there are anterior occlusal prematurity's
8. Prevention of damage to occlusion eg. Milwaukee braces.
9. Extraction of supernumerary teeth
10. Space maintenance
11. Management of deeply locked first permanent molar
12. Management of abnormal frenal attachment.

**Interceptive orthodontic procedures [9]**

Serial extraction = Dewel method, tweed method, Moyers method.



Dewel Method



Moyers Method

1. Correction of developing crossbite
2. Control of abnormal habits
3. Space regaining
4. Muscle exercise
5. Interception of skeletal malrelation
6. Removal of soft tissue or bone barrier to enable eruption of teeth

**Space maintenance & maintainers**

Space maintenance = preservation of space left by primary incisors, primary canines, and primary molars and sometimes the primate spaces [10].

Space maintainers = device used to maintain the space created by the loss of a deciduous tooth [10].

**Indication [10]**

1. Preserving arch length following premature loss of a primary tooth/teeth,
2. Allows permanent tooth to erupt without hindrance into proper alignment and occlusion.

**A space maintainer should fulfil the following criteria [10]**

1. Maintain entire mesio-distal space created by a lost tooth.
2. Must restore function as far as possible and prevent over eruption of opposing teeth.
3. Be simple in construction.
4. Be strong enough to withstand the functional forces.
5. Not exert excessive stress on adjoining teeth.
6. Must permit maintenance of oral hygiene.
7. Normal growth and development and natural adjustments that take place during the transition from deciduous to permanent dentition must not be restricted.
8. Should not come in the way of other function.

**Planning for Space Maintenance depends on**

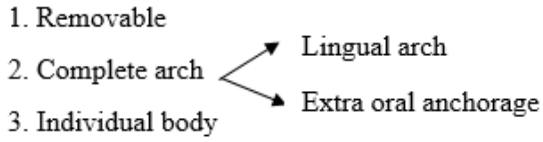
1. Time elapsed since loss
2. Dental age of the patient
3. Amount of bone covering the unerrupted tooth
4. Sequence of eruption of teeth
5. Delayed eruption of the permanent tooth
6. Congenital absence of the permanent tooth
7. Presentation of problems to parents

**Classification of space maintainers [9]**

**According to Hitchcock**

1. Removable or Fixed or Semi fixed
2. with bands or without Bands
3. Functional or Non Functional
4. Active or Passive
5. Certain combination of the above

**According to Raymond C. Thurow**




**According to Hinrichsen**

1. Fixed space maintainer

Class 1

a) Non-functional types

I) bar type

II) Loop type

b) Functional types

I) Pontic types

II) Lingual arch type

Class 2

Cantilever type (distal shoe, band & loop)

2. Removable space maintainers

Acrylic partial dentures

**Some commonly used removable space maintainers.**

1. Acrylic partial denture
2. Full or complete denture
3. Removable Distal Shoe space maintainer

**Some commonly used fixed space maintainers**

1. Band and loop space maintainer
2. Band and loop space maintainer with occlusal rest
3. Crown and loop appliance.
4. The lingual arch space maintainer
5. Palatal arch appliance
- Nance arch holding appliance
- Transpalatal arch
6. Esthetics anterior space maintainers
7. Band and bar type space maintainer
8. Pin and tube space maintainer
9. Gerber space maintainer
10. EZ space maintainer
11. Distal shoe space maintainer

**Space maintenance in anterior segment**

1. Removable partial denture
2. Fixed Appliances
3. Groper Appliance

**Space maintenance in buccal segment**

1. Removable appliances
2. Fixed Space Maintainers
- Band and loop appliances (Fig 8)
- crown and loop ( Fig 9)
- Mayne Space Maintainer- Designed by W R Mayne,
- Distal shoe - Intra-alveolar appliance- It was introduced by Gerber and extended by Croll. (Fig 10)
- Band and Bar
- Glass Fiber-reinforced Composite Resin
- Fixed lingual arch –popularised by Burstone, (Fig 11)
- Nance palatal arch appliance - developed by H.N. Nance in 1947, (Fig 12)
- Transpalatal arch- Originally described by Robert Goshgarian in 1972,

**Fig 8:** Band and Loop

**Fig 9:** Crown and Loop

**Fig 10:** Distal Shoe

**Fig 11:** Lingual arch

**Fig 12:** Nance Palatal Arch

**Correction of mandibular anterior crowding, following eruption of mandibular lateral incisors [6].**

1. Stripping of teeth to resolve crowding
2. Lingual arch
3. Mandibular expansion
4. Extraction treatment
5. Lower incisor extraction treatment
6. Second molar extractions in the lower arch:
7. Lower first molar extractions
8. Mandibular lip bumper
9. Vestibular screen

**Correction of developing crossbites**

Various treatment methods proposed such as [20]

1. reversed stainless steel crowns,
2. tongue blades
3. fixed acrylic planes
4. bonded resin-composite slopes
5. reverse pull facemask
6. Removable acrylic appliances with finger springs.
7. fixed inclined bite planes
8. Bruckl appliance
9. Hawley appliance with a lingual shield
10. Hawley appliance with midline expansion screw
11. coffin spring

**Maxillary biomechanics / Maxillary expansion appliances [8]**

1. Cross-arch elastics
2. Removable Schwarz Plate
3. W-arch / Quad-helix (0.036 S.S. wires)
4. Palatal Expander/Hyrax
5. Hass expander

**Space Regaining**

- Gerber space regainer
- space regainers using jack screw
- space regaining using cantilever spring

**Maxillary space regaining**

- Extraoral headgear,
- Fixed molar "distalizing" appliances (e.g. Distal jet),
- Removable ACCO appliance are examples modalities.

**Mandibular space regaining**:

- lip bumper
- "active" lingual arch,
- Removable split-saddle.

**Space gaining methods**

- proximal stripping
- expansion
- extraction
- distalization
- uprighting the molars
- derotation of molars
- proclination of anterior

**Interception of skeletal malrelations**

Defined as biomechanical treatment directed at altering relationships of the jaws and activity patterns of orofacial muscles to affect changes in facial proportions.

| | |
|---|---|
| 1. Skeletal class II malocclusion due to maxillary prognathism | Restrict maxillary growth using headgear |
| 2. Skeletal class II malocclusion due to mandibular retrognathism | Myofunctional appliances to promote mandibular growth |
| 3. Skeletal class II malocclusion due to mandibular retrognathism and maxillary prognathism | Headgear + myofunctional appliance |
| 4. Skeletal class III malocclusion due to mandibular prognathism | Chin cup therapy to restrict mandibular growth |
| 5. Skeletal class III malocclusion due to maxillary retrognathism | Myofunctional appliance to promote maxillary growth and face mask therapy |
| 6. Skeletal class III malocclusion due to maxillary retrognathism and mandibular prognathism | Facemask therapy and chin cup to restrict mandibular growth. |

**Anteroposterior Class II malocclusion with Retrusive Mandible > Functional Appliances**

Promote growth of mandible by advancing mandible with protrusive bite appliance, restrain maxillary forward development for "catch-up" [8].

**Correction by [8]**

a) Moving (or restricting) upper teeth backward - moving the lower teeth forward.
b) Restraining maxillary skeletal growth (i.e., so-called "headgear effect").

**Examples of functional advancement appliances [8]**

1. Bionator / orthopedic corrector
2. Activator
3. Frankel
4. Herbst

**Anteroposterior Class II Malocclusion with Protrusive Maxilla > Directed Headgear**

Headgear promotes restraint of maxillary dental and skeletal forward and vertical development, distalized upper dentition, and allows normal mandibular growth. Orthodontic and orthopedic effects are possible with directed headgear in growing patients [8].

**a. Cervical-pull Headgear:** Optimize molar distalization, redirect vertical development, and influence maxillary skeletal growth, decrease overbite, promoting molar extrusion, distalization of crowns. Average 3 mm. /year distalization.

**b. High-pull Headgear:** Optimize orthopedic restraint of maxillary growth and minimize vertical eruptive development, enhance overbite, promotes horizontal and bodily movement of molars, distalization effects are minimal.

**Anteroposterior Class II malocclusion with acceptable A-P skeletal / profile relationships**

Promote corrective changes by restraining or distalizing upper dentition, protracting lower dentition.

1. Class II elastics: requires Edgewise appliances.
2. Distalized maxillary posterior segments (e.g. headgear, distal jets, ACCO, springs, etc.).
3. May incorporate selective permanent tooth extractions to camouflage A-P discrepancy.

**Control of excess vertical facial development**

1. Maxillary restraint with high-pull headgear
2. Maxillary restraint with full coverage functional appliances (Combine Activator-Headgear)

**Anteroposterior Class III Malocclusion**

- Restrain mandibular growth with Chin-cup therapy
- Protract the maxillary complex with extraoral reverse-pull headgear (facemask)

**There are many orthodontic problems that need evaluation for treatment in the mixed dentition [8]**

- Class II malocclusion and Class III malocclusions with midface discrepancies
- Anterior crossbites and posterior crossbites
- Midline discrepancies, associated to early loss of a deciduous cuspid
- Overjet over 6-7mm
- Crowding up to 4mm
- Deep overbite associated with palatal impingement
- Ectopically erupting Cuspids and molars
- Mucogingival problems

- Premature loss of deciduous molars
- Missing permanent teeth or supernumerary teeth

**Conclusion**

Early intervention can simplify or eliminate need for later treatment. Treatment in mixed dentition opens doors for an orthodontist and a pedodontist to apply his judgment and experience. Proper diagnosis and treatment planning can produce most satisfying results during the mixed dentition stage. On other hand, lack of careful planning can lead to disastrous results. It should be remembered that there is generally greater danger in: "Too much too soon, rather than in too little too late."

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