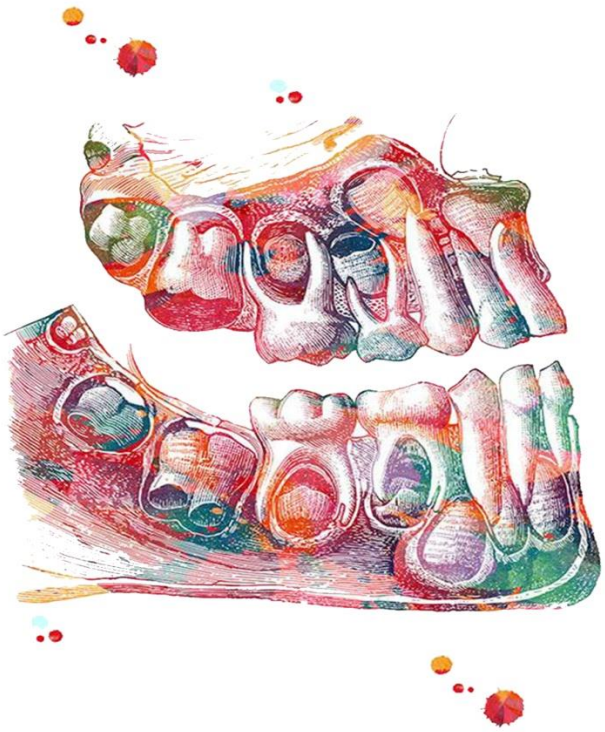

Pediatric Dentistry

Done by: خالد قرعاوي + لمى أبو فضالة

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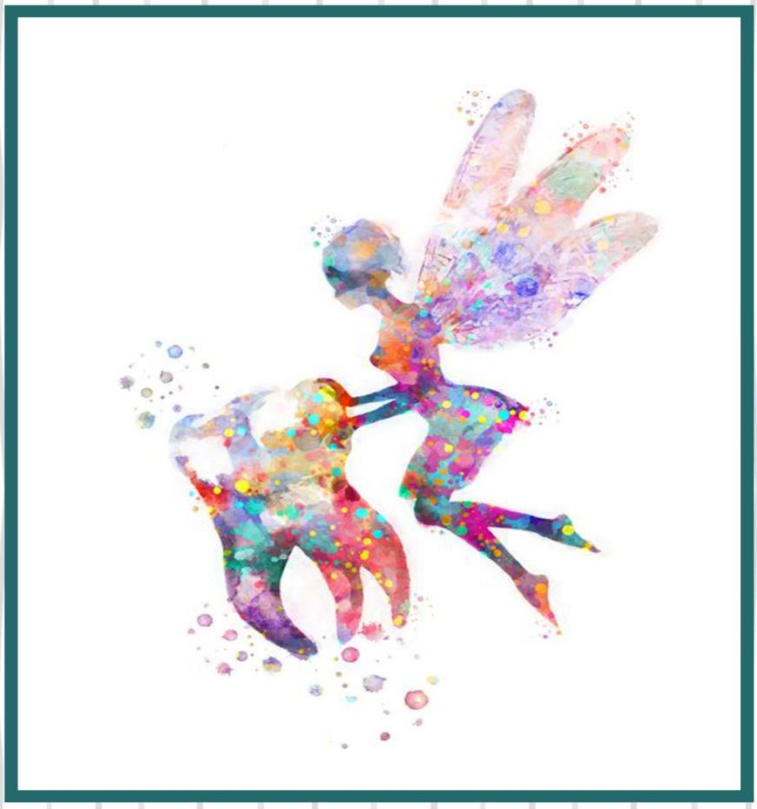
Lecture # 2



لجنة طب الأسنان
Dental Committee

Development of Occlusion and Space Loss

- As we all know the primary dentition starts to develop at 8 months of age (on average) starting with the eruption of the lower central incisors→ upper centrals→ laterals→ first molars→ canines→ second molars.
- At 6 years of age, the permanent dentition starts to develop where the child will be in the mixed dentition stage and once the old primary dentition is replaced by the permanent dentition, we will be in the permanent dentition stage.
- Ideally, as the occlusion develops from the primary dentition through the transitional (or mixed) dentition to the permanent dentition, a sequence of events occurs in an orderly and timely fashion, any interruption in this order may lead to discrepancy and farther problem.
- And during the transitions between these stages there will be differences so our goal as dentists is to maintain the occlusion to be functional, esthetic and stable.

❖ Clinical evaluation of the primary dentition:

- The primary teeth start to erupt at 6-8 months of age (depending on different factors)-starting from lower centrals→ upper centrals →lower laterals →upper laterals- ending with upper second primary molars, until 3 years of age (30 months) all the primary teeth fully erupted and primary occlusion is established.
- The sequence of eruption: A – B – D – C –E.

(This is the most common sequence, but it differs between children), so having discrepancies doesn't mean anything abnormal unless a tooth didn't erupt at all.

- The primary dentition occlusal relationships are established at 36 months of age (3 years) where all primary teeth are erupted. An occlusal relationship is established and maintained until mixed dentition stage which is around 6 years of age. After the occlusion is established there are very minimal changes (width, length, perimeter) until permanent dentition eruption. تقريبا ما بيتغير

- From 3 to 5-6 years ---- mixed dentition stage

❖ Variables that influence eruption (both dates and sequences):

- **Genetics**
  - Familial tendencies (in some families, teeth eruption is earlier or delayed than other families).
  - Taking history from parents will help you in knowing that it's normal.
  - African Americans have earlier (faster) eruption than Caucasians.
  - Females have earlier (faster) eruption than males.
- **Environmental**
  - Low birth weight might cause delay in eruption.
  - The use of ventilators can delay the eruption.
- **Systemic**
  - Endocrinal disorders (hypopituitarism, hypothyroidism) associated with delay eruption.

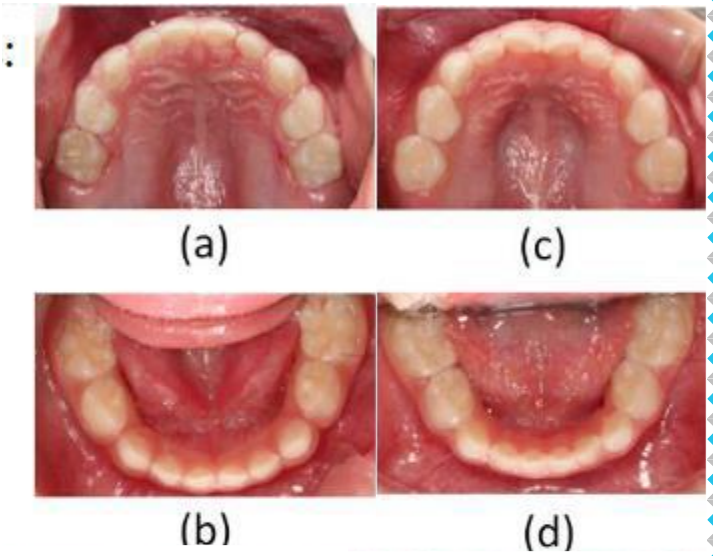
❖ Characteristics of the primary dentition occlusion:

Once the primary dentition occlusal relationship is established, there are some characteristics of the primary dentition we are going to notice, and these characteristics are almost present in all children:

1. **Generalized spacing:**

- Most of the time we see children with spaced dentitions.
- Mostly seen in children less than 6 years of age (primary dentition stage).

- This spaced dentition is referred to as **Baume type I dentition** which is (a&b):
    - generalized spacing between all teeth with midline diastema.
    - sometimes you can see the interproximal surfaces of posterior teeth.
    - found in almost **2/3 of the population**.



- The other type is non-spaced dentition, which is referred to **as Baume type II** (c&d), present in **1/3 of the population.**

2. Primate spacing

- Other than the generalized spacing, we have what is called primate spacing which is the **space that is present (distal to lateral incisor in upper arch) mesial to the upper canines and distal to the lower primary canines** and we can <u>find primate spacing in both Baume type I and II</u> (spaced or non-spaced arches)

- Once established, arches remain spaced or non-spaced over the course of primary dentition. (At age of 3 we will know if the dentition is spaced or not and this will not change until the permanent teeth start to erupt).
- Spaced and non-spaced arches are related to **basal arch size** (basal bone) rather than the tooth mass differences (size of teeth). يعني حجم الأسنان مش كتير بأثر
- The importance of spacing: to allow space for the permanent dentition since it's larger than the primary.
- Studies and research showed that primary spacing affects the crowding in mixed and permanent dentitions.

(Depending on the amount of spacing seen, we can expect if there will be crowding or not especially in the incisal area).

Primary spacing affects crowding outcome predictors into the mixed dentition:

- spacing 3 to 6 mm. => no transitional crowding
- spacing less than 3mm => 20% with incisor crowding
- no spacing => 50% with incisor crowding
- crowded primary teeth =>100% with incisor crowding

حابب أأكد على نقطة تخلوها ببالكم انه لو اجاكم مريض عنده Baume type II (has no spacing in his primary dentition) مش بالضرورة انه الأسنان الدائمة في ال mixed dentition stage حتكون crowding، الاحتمالية فقط 50%

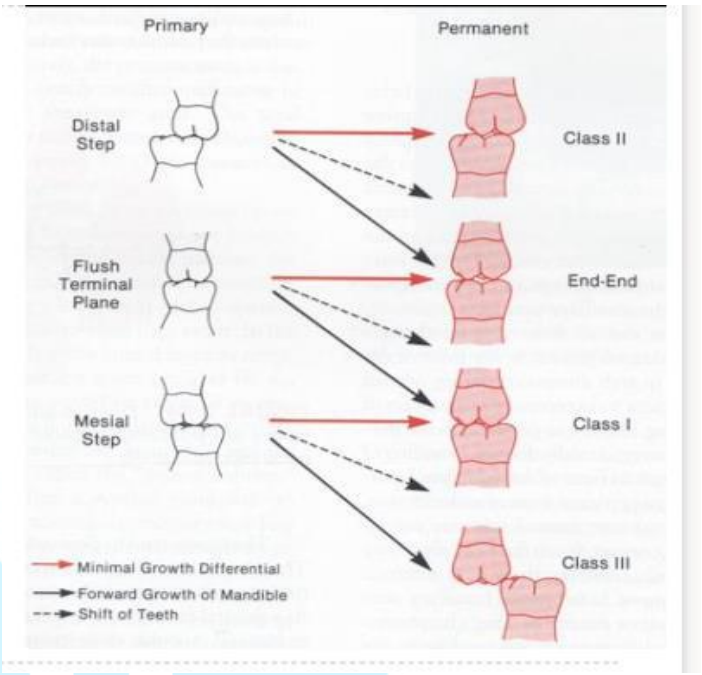
❖ Occlusal Relationship of Primary Teeth:

Molar Terminal Plane Relationships (Baum's relationships)

- We need to differentiate between angle's relationship (between permanent first molars) and Baum's (relationship between primary second molars)

- For Baum's relationship (we are looking at the distal surfaces of primary second molars) we have:
  - Flush terminal: most common, when the upper and lower are on the same line, found in 75% of the population, results in end-end (half unit class II) relationship that will usually shift to class I due to growth of the mandible that will cause mesial shift of the lower E. However, some of them will stay end-end or shift to full class II. We will talk about how the shift happens after two pages so keep it in your mind.

- Mesial step: less common, when the distal surface of the lower molar is mesial to the distal surface of the upper molar, found in 15% of the population, usually results in class I permanent molar relationship, but in some cases due to (severe) mandibular growth pattern it might develop to class III malocclusion.
- Distal step: if the distal surface of the lower molar is distal to the distal surface of the upper molar, will usually result in full class II malocclusion, some will shift to end-end (half unit class II) relationship. However, sometimes with the mesial shifting of the lower it might result in class I relationship (less common).



Summary

Flush terminal → majority shift to class I, minority stay end-end or class II

Mesial step → majority class I, minority class III

Distal step → majority class II or end-end, minority class I

- It's important to know this relationship since it influences the relationship of the permanent first molars.

Canine relationships:

- Best predictor of sagittal relationship in the permanent dentition
  (Since sometimes we can't know the molars relationship when there is early loss of the Es and Ds so the 6s will be in different positions and we can't know the actual relationship between the 6s).
  - Mesial step: upper canine is in the embrasure between lower canine and lateral incisor, usually results in class 1 relationship.

- Distal step/end to end: where the upper and lower canine cusps are occluding against each other, usually result in class II or end-end permanent dentition occlusion.
- Excessive mesial step: upper canine is more posterior (with incisor crossbite) which is usually results in class III permanent dentition.

Incisor relationships:

- Normal incisor relationship would have:
  - Overbite: 0-2mm (30-50% vertical overlap)
  - Overjet: 0-3mm

❖ **"Ideal" Primary Dentition Occlusion** (which will most probably result in ideal permanent occlusion)

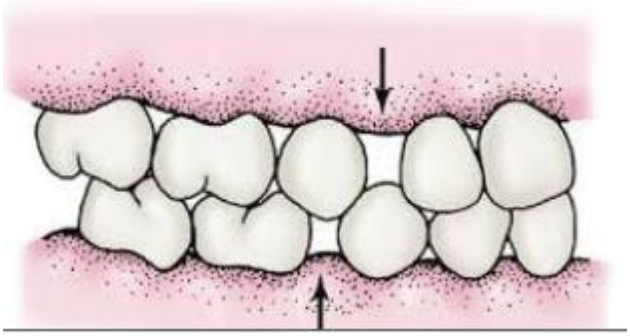
- Flush terminal plane or mesial step molar with Class I canines
- Generalized spacing including primate spaces
- 2 mm overjet & 2 mm overbite (30%)

❖ Tooth migration and Arch Changes during Development of Occlusion

متذكرين لما كنا نحكي عن ال flush terminal قلنا انه بتعطينا end-end وممكن يصير shift فبتتحول class 1، طيب شو الي بخلي ال shift يصير؟ هاد الي حنكي عنه

During the mixed dentition stage we have some tooth migration and movement that changes the relations that we talked about earlier:

- **Primate spaces:**
  - As we said earlier, it's mesial to the upper canine and distal to the lower canine.
  - Seen in the primary dentition only.
  - Incidence: 70% in the maxillary arch and 63% in the mandibular arch
  - Congenital rather than developmental
  - 2 distinct diastemas
    - Maxillary laterals and canines: 1.7mm



- Mandibular canines and first molars: 1.5 mm

- **Leeway space**
  - Is the space that results from the difference in the mesio-distal width of the primary canine, first and second molars and permanent canine, first and second premolars.
  - Premolars are smaller than the primary teeth they replace
  - we find it in both the mandible and the maxilla.
  - It's wider in the mandible, because the size of permanent maxillary larger than permanent mandibular, and the mandibular primary larger than maxillary primary.

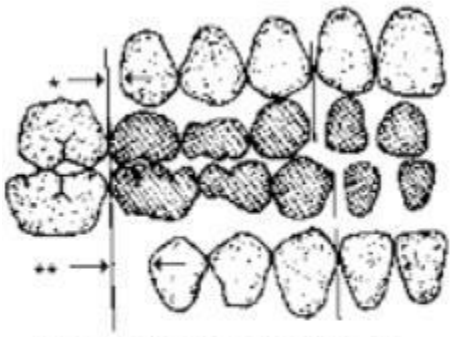
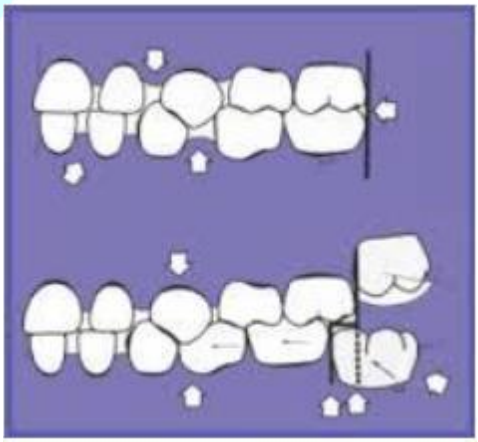


Illustration of the Leeway Space

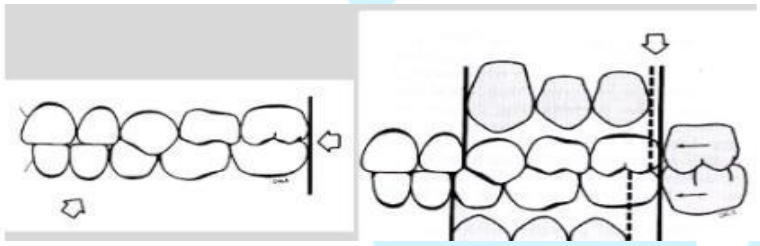
  - Leeway space in each quadrant:
    - Maxilla: 1.5 mm.
    - Mandible: 2.5 mm.
  - It can be used to adjust the occlusal relationship between the upper and lower permanent first molars resulting in class I occlusion (in the late mesial shift). However, in some cases that we have crowding in the anterior segment, we usually put space maintainers to prevent the 6s from moving mesially and allow the space to be used.

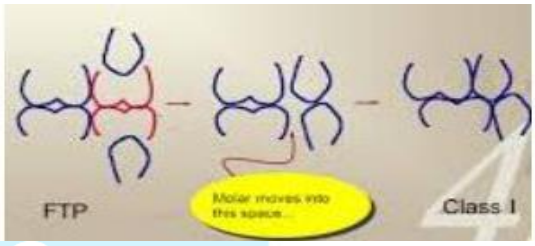
- **Early mesial shift:**
  - Mesial migration of the erupting mandibular permanent molar.
  - It uses the mandibular primate space.
  - Results in class I molar relationship, due to eruption pressure and forces of the 6, it can push the D and E mesially resulting in class I relationship instead of end-to-end relationship. Because of this shift the flush terminal occlusion, becomes class I molar relationship.
  - Also, we can see that the relationship between the Es has changed from flush terminal to mesial step.



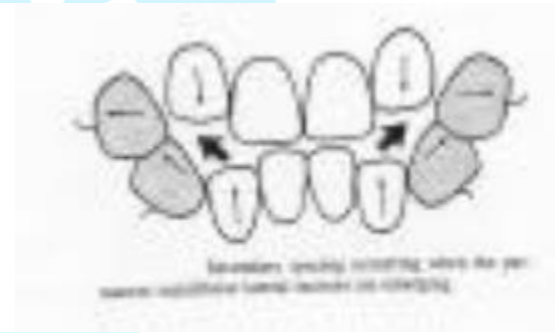
- Occurs around 6 years of age (eruption of the 6)
- Seen in arches (63%) that have the mandibular primate space.

- **Late mesial shift**
  - Mesial migration of erupted mandibular permanent molar after the loss of the primary second molar.
  - Uses the Leeway space.
  - Seen in the late stage around the age of 11 years.
  - Seen in all cases.
  - It can adjust the occlusion into class I occlusion. So, if the occlusion did not become class I in the early mesial shift, it still have chance to become class I in the late mesial shift.





- **Secondary Spacing:**
  - Usually occurs in primary arches that have no primary spacing.
  - When the mandibular permanent lateral incisors erupt, the primary mandibular canines are moved laterally and buccally, thus creating space for the maxillary permanent lateral incisors also to erupt.



❖ Premature Loss of Primary Teeth -Space Maintenance in the Primary Dentition

As you know each tooth has timing to fall and to erupt, and when the primary falls the permanent erupt, and this is the usual normal process, but sometimes due to caries, trauma or other reasons there will be premature loss of primary tooth, and the space sometimes are preserved sometimes are not, so when we need to do space maintainer?

- **Primary incisors:**
  - Mos of the time loss is due to caries or trauma.
  - Space loss unlikely if primary canines erupted into occlusion, they would hold the space. So, no need for space maintainer.
  - However, if the primary canines were lost too, we might expect some movement affecting the eruption of the permanent.
  - Generally, if we lose primary incisors A&B: we don't need space maintainers.

- **Primary canines:**

There are different reasons of losing primary canines:

  - Usually due to ectopic eruption of permanent laterals as sign of overall space deficiency -beyond simple space maintenance (usually this problem will be fixed by ortho treatment at an older age).

يعني فعليا هون عنا احنا نقص مساحة من الأساس، بحيث انه الlateral incisor اضطر انه يطلع مكان الناب اللبني، وهاد هو سبب فقدان الناب اللبني فبالتالي هاد الاشي ما بتعالج بإنا نحط حافظ مسافة، هاد بده ينعمله تقويم وغالبا حنضطر نخلع من الأسنان الدائمة.

  - **If loss of canine secondary to caries or trauma:**
    - In cases of unilateral loss, space maintenance is needed to maintain midline symmetry, or we can extract the other to balance.
    - If the loss was bilaterally, most of the time we don't need space maintainers, and we will not worry about the midline.
- **First primary molars:**
  - Space maintainers are indicated if the first permanent molars are in active eruption (so it's important to know when the loss of Ds happened).
  - If the 6s are not fully erupted: we need to preserve the space by space maintainers especially in the lower arch and also in the upper arch.
  - If the 6s are already there: we don't need space maintainer, unless it was unilateral loss of the D we might need one to preserve the midline symmetry.
  - Once first permanent molars erupt into occlusion, space loss negligible if first primary molars lost during mixed dentition and second primary molars remain to buttress first molar position.

- **Second primary molars:**
  - Regardless of timing, space maintenance generally indicated as space loss occurs in primary or mixed dentition (especially in the upper arch).
  - Space loss greater in upper arch as maxillary first molars move forward bodily & rotate around palatal root -tipping not a major factor.
  - Lower molars evidence mesial & lingual crown tipping, less notable bodily movement.
  - Space loss in either arch most dramatic in timing association with eruption of first permanent molars.

Summary for space maintainer indications:

Incisors→ no need.
Canine→ only in unilateral.
Ds→ when the 6s are in active eruption or unerupted.
Es→ always need space maintainers.

❖ Effects of Premature loss of a Tooth

- Loss of arch circumference: (distance from mesial of 6 on one side to the mesial of the 6 on the other side) because of movement of the 6s resulting in less space for the bigger permanent teeth thus crowding in succedaneous teeth.
- Delayed or accelerated eruption of succedaneous teeth (depending on the timing and circumstances of extraction)
  - If I extract the primary tooth when its close to shedding I'll accelerate the eruption of the permanent tooth below especially if we have a periapical lesion or inflammation causing root resorption of the primary.
  - If I extract the tooth way before its shedding time I will delay the eruption of the succedaneous tooth.

how does that happen? if the premature loss is very early, the soft tissue will become fibrous and thicker so harder for the tooth to erupt especially in the anterior area,

❖ Eruption Timing and Sequencing of Permanent Dentition

- The primary dentition reaches the occlusion at the age of 3 and at the age of 5.5-6 permanent dentition starts to erupt (mixed dentition stage) and ends at the age of 12 -13 where the 7s erupt. Most common eruption sequence is:
  - 6-1-2-4-5-3-7 in the upper arch
  - 6-1-2-3-4-5-7 in the lower

    Above sequences occur only about 50% of the time

    The most common variation is eruption of second molars in either arch before anterior teeth.
- Mid mixed stage (8-10 yo) is the stage where permanent incisors ad 6s are fully erupt but the buccal segment (C,D,E) are still primary, we might need space management because of premature loss of teeth also functional ortho appliances take place at this stage.
- incisor transition is complete by 8 years to establish the mid-mixed dentition of permanent molars and incisors along with buccal segment primary teeth (C-D-E)
- 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.
- Second molars erupt about 12+ years of age

❖ Normal Mixed Dentition Occlusion and Alignment

After incisor transition in the early mixed dentition years, the incisors normally exhibit:

- On average, 1.6 mm. of lower incisor "crowding" (i.e. slight "crowding" normal, regardless of primate space) (this crowding will be relieved with the growth of the child)
- On average, no spacing or crowding in the upper incisor segment.
- The "Ugly duckling" stage is normal transitional appearance with "splayed" maxillary incisors under influence of eruptive positions of canine in relation to lateral's root. During this stage: central incisors normally appear proclined, flared with midline diastema, a lot of parents are concerned about this appearance and seek orthodontic treatment for their children, so you need to reassure them that it's normal and once the laterals and canine erupt occlusion will be aligned properly.
- Overjet-Ideal is no overjet with incisal contact, (range is 0 -3 mm.)
- Overbite -Ideal is about 2 mm. or 30 -50% vertical overlap.

❖ Incisor liability

Permanent incisors are larger than primary incisors: 7.1 mm space discrepancy in upper and 5.1 mm in lower.

Transition from primary incisors to permanent incisors is possible because:

- Interdental spacing of primary teeth if available -Baume Type I, primate spaces –allows incisor transition with less than mean average of 1 to 2 mm. incisor crowding. Larger basal arch size. If not available, much more likely to end up with crowding at above average levels.

❖ Increase in inter-canine arch width during incisor eruption and "growth" transition".

- Lower inter-canine width increases at mean of 2.4 mm (range of 0 to 5 mm), until the age of 8 which is age of eruption of permanent incisors. Permanent canines will erupt at same arch width as the primary canines occupied
- upper inter-canine width increase at mean of 3.0 mm (range of 0 to 6.5 mm). Another increase of about 2 mm will occur in the maxillary width at the age of 12 years which is when the permanent maxillary canine erupts

-placement of permanent lower incisors is lingually to the primary incisors so they push the primary with the force of the tongue then they erupt

- More anterior/buccal placement of upper permanent incisors increasing arch circumference and more space to erupt that's why we see less crowding in the upper although the teeth are bigger.

❖ Permanent Molar Relationships in the Mixed Dentition

- Class I: Maxillary first molar mesial cusp in mandibular molar buccal groove which is the "Ideal".
- End-on Class II: (Majority of mixed dentition occlusions) Potentially corrects to Class I with late/early mesial shift in late transition stages in most cases; but may stay end-on or even shift to full Class II.
- Full Class II: Maxillary first molar mesial cusp is in the embrasure between lower first molar and second primary molar or second premolar. About 15% of children express full Class II molars –usually reflection of skeletal malocclusion (involving mandibular retrognathia as most common causative factor) Canines also Class II positioning with pronounced overjet of 6 mm. or more.

- Class III: Maxillary first molar mesial cusp distal to lower first molar buccal groove. in about 1 to 3% of Caucasian children, usually reflects skeletal malocclusion (prognathic mandible and retrognathic maxilla)

We need to differentiate between class III malocclusion and pseudo class III (which can be due to premature contact or occlusal interferences)

❖ Permanent molar transition positioning influenced by:

• Primary molar terminal plane relationship.

• Spacing: primary spacing may be closed by "early mesial shift" as first molars erupt

• Size differential between primary C-D-E and permanent 3-4-5 teeth (i.e. leeway space) allows "late mesial shift" of first molars when second primary molar exfoliates and permanent first molar moves mesial, often under the influence of erupting second molar.

- Upper leeway space is +0.9 mm per quadrant
- Lower leeway space is +1.7 mm. per quadrant.

• Mandibular growth and differential growth may affect relative A-P positioning (may change from class I to class III due to this A-P growth of the mandible).

❖ Arch Length

- The distance from the distal surface of the second primary molar (or mesial surface of the first permanent molar in case of the 6s were erupted) on one side of the arch to that same surface on the opposite side. (Using a cast and a ruler.)

- Decrease in arch circumference as child grows –seen during the mesial migration of first permanent molar during the late mesial shift due to the use of leeway space.

So, at early dentition stage we can found the arch length decreased compared to the permanent dentition which is normal.

❖ Summary

• The development of the occlusion is an orderly sequence of events. So it's important to understand the sequence of eruption in order to decide when to use a space maintainer and when not to use.

• Any variation in this sequence will result is some form of malocclusion.}

• There are several forces that act on a tooth in the arch.

• Natural teeth are the best space maintainers so preserve as much as you can.

• There are several spaces present in the primary dentition that allow space for the larger permanent dentition.