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ORTHODONTICS

slides

handout

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Lecture Outline:

- What is occlusion?
- Teeth Development
- Dimensional Changes

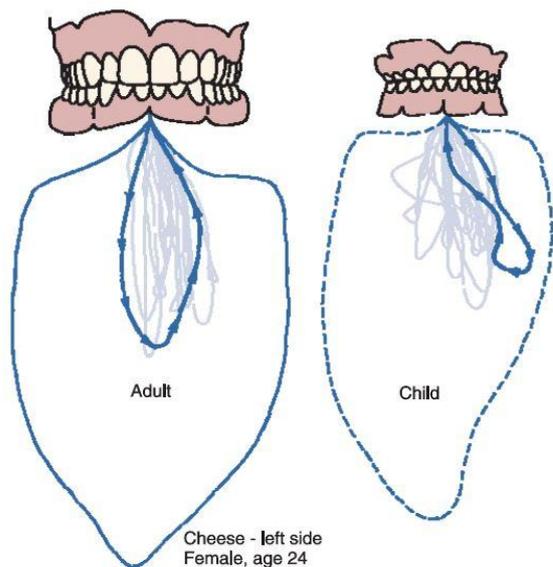
1.Occlusion is defined as the relationship between the maxillary and the mandibular teeth "this is a static occlusion".

But actually what's important than this is the actual relationship during function, mastication, speech, swallowing, breathing, all these are considered as relationships.

So if we want to talk about occlusion, we need to talk about teeth and their morphology, Muscles of mastication, TMJ, Nerves, Blood supply, Function and Movement.

You look at the envelope of movement "jaw movement" from the front so basically it's more complicated than basic and static occlusion.

When you are talking about malocclusion and you want to treat it If you don't know what's normal you can't spot what's abnormal.



2.Stages of development :

- late fetal development
- Eruption of primary teeth
- Eruption of permanent Teeth > and that's will make the total of the main part of occlusion

Timing for calcification of each primary tooth and when the crown is completed, when the tooth erupt and when the root is completed



Chronology of Tooth Development, Primary Dentition

Tooth	CALCIFICATION BEGINS		CROWN COMPLETED		ERUPTION		ROOT COMPLETED	
	Maxillary	Mandibular	Maxillary	Mandibular	Maxillary	Mandibular	Maxillary	Mandibular
Central	14 wk in utero	14 wk in utero	1½ mo	2½ mo	10 mo	8 mo	1½ yr	1½ yr
Lateral	16 wk in utero	16 wk in utero	2½ mo	3 mo	11 mo	13 mo	2 yr	1½ yr
Canine	17 wk in utero	17 wk in utero	9 mo	9 mo	19 mo	20 mo	3¼ yr	3¼ yr
First molar	15 wk in utero	15 wk in utero	6 mo	5½ mo	16 mo	16 mo	2½ yr	2¼ yr
Second molar	19 wk in utero	18 wk in utero	11 mo	10 mo	29 mo	27 mo	3 yr	3 yr

These times are important ,Not every patient should follow the exact timing but at least they are a guideline .know these are averages and the rest of Normal population (97%) will follow the average +- 2 standard deviations

so these guidelines help in determining the best timing for the beginning of eruption

The most important here is the first time of calcification and time of eruption in general.

There is a simplified table about this in Laura Mitchell's book, It looks only at the time of calcification and time of eruption that you can check it if you want.

So as you can see all primary teeth starts calcification before birth,3-4 months in uterus first onset of calcification happens and you can identify that the first tooth in primary dentition calcified is the central incisor>lateral>1st molar>canine>2nd molar

Take care we are talking about primary dentition .

In terms of eruption, Central incisor 6-7 months after birth, 7-8 months lateral, 1-1.5 year 1st molar, 1.5-2 years canine, 2-3 years 2nd molar.



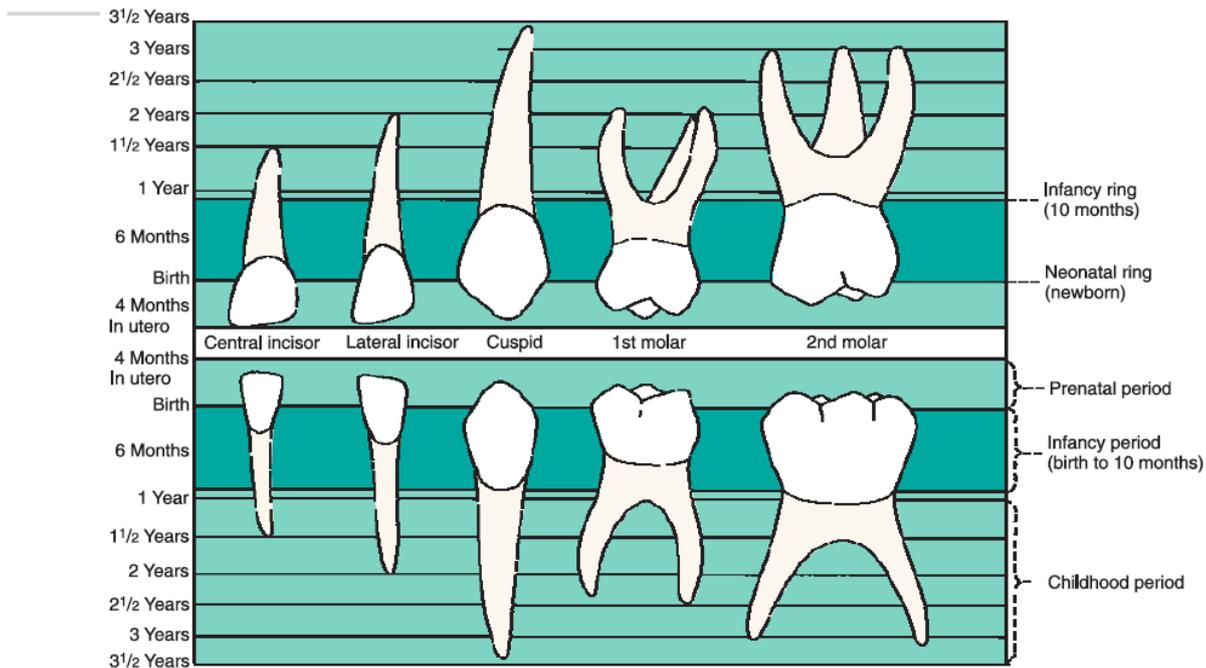
Birth is considered a traumatic process for the child, and to make it easy for this big head to become through birth canal during delivery:

-we have the uncalcified fontanels that can squeeze during delivery

-The second factor is the under development of the mandible, the mandible is under developed relatively to the maxilla and the rest of the facial bones."Cephalococcal gradient drop"

so this process will be easier





The start of Birth

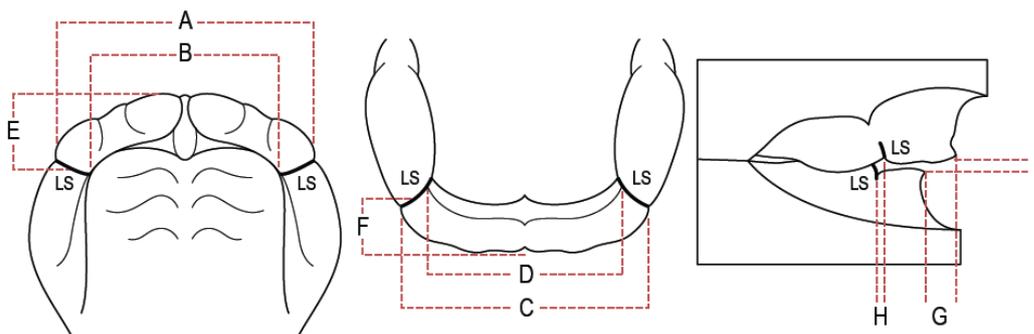
at 3-4 months the start of calcification

Birth is considered a traumatic experience for the child , so we are going to have :
a line called a Neonatal Line

Red line resembles from birth How much calcification is finished in the primary dentition

If you have any traumatic experience ,Nutritional deficiency, starvation ,chronic illness , Trauma ,Accidents , if they lasts weeks or more they will have visible line , visible lines during the calcification of teeth .

The child normally has one neonatal line



Another normal development after birth is the Relation of the maxilla to the mandible, there is no teeth in this, but they have a specific relationship, they are covered by dense fibrous periosteum, and the shape of the maxillary bone is horse shoe shaped, a bit wider and lower and the mandible pad is a U shaped, straighter at the molar area and a little bit shorter Than the Maxilla.



So when They are Placed against each other, I will have a little bit of Overjet "which is Normal at that age "

It will reduce with time as the mandible Recap "grow faster relatively and more, and we don't consider that they will meet "Maxilla and mandible", except at molar area and finally we will have a space called anterior open bite.

The maxilla is positioned anterior to the mandible that means we have overjet , a little bit of overjet is considered Normal , it will reduce by time as the mandible recap ,The mandible will grow relatively faster and more than the maxilla .

During function we don't expect the maxillary and the mandibular gum pads to meet, But if they meet it will be Normally in the molar area, and in the front we will have a space called Anterior open bite for the tongue, because the tongue has to rest there most of the time because the main function the babe does is sucking ... and all of this is considered Normal.

Deciduous dentition stage

the primary dentition stage is the stage from the first primary tooth eruption all the way till the first permanent tooth erupts.

We stop calling this primary dentition, we call it mixed dentition.

The primary teeth will start calcification before birth, 3-4 months intra uterine as a general Rule -The mandibular primary Teeth usually erupt before the maxillary primary teeth. The first tooth to erupt is usually the mandibular central incisor, followed by the rest of the incisors After 3-4 month interval –mostly- "This is the first Gap", the mandibular and maxillary first molars erupt, followed another 3-4 month "2nd Gap" then followed by the maxillary and mandibular canines eruption, primary dentition is usually completed at 24-30months as the mandibular, then the maxillary second molars erupt lastly. (Any disturbance in this sequence will indicate something wrong)

As general Rule, Root calcification, finished, complete 1-1.5 year after eruption.

These general Rules are guidelines but What's more important in detecting abnormality is the sequence of eruption .Some children will have +- 6 months deviation for the timing of eruption and calcification.

(Disturbance in sequence isn't acceptable; disturbance in timing is acceptable up to 6 months)

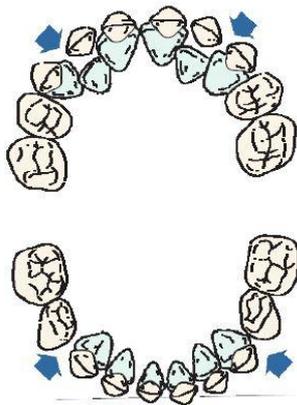
If you have a child was brought to your clinic by his parents (10 or 12 months old) , and he hasn't any tooth in his mouth , Don't panic , just reassure his parents that it is a normal deviation , No other investigation ,just keep Close eye on eruption .

As the teeth erupt the vertical relationship between the maxilla and the mandible which we called the Anterior open bite, usually decreased by the upper incisors cover 1/3 of the lower incisors, and this is considered Normal .After that this will be reduced by vertical growth and attrition of teeth, It might reach edge to edge which is still considered Normal.

We start with deep Overjet, Overbite and It will reduce gradually to Normal So don't panic in Clinic.

Spacing





If a patient with full well aligned primary dentition this is considered abnormal .well aligned means permanent teeth which are wider and larger will erupt in crowding.

So spaced arch in primary dentition is Normal and it increases with time because we have a development of the arch, this is called generalized spacing.

And with time you will have a special spaces called Primate spaces, which are located mesial to the canine in the upper arch and distal to the canine in the lower arch.

And all of these spaces help in smooth transition from primary to permanent dentition and they are considered mandatory to have symmetrical and permanent dentition that's +/- well aligned

For posterior deciduous teeth I look at the terminal planes of the primary 2nd molar, which are the distal surfaces of the 2nd Molar, The Normal is to have A flush terminal planes, looks like process of determining the class I molar relationship in permanent molars. "Flush means that both are at the same line"

Posterior teeth we look at the terminal planes of the deciduous second molar position "Distal surfaces of primary second molar" , the normal is to have flush terminal planes "at the same line'

Sometimes the child came to you with what we call a mesial step or distal step molar relationship in the primary dentition

Permanent Dentition:

Eruption is divided into 2 important stages:

- Preemergent Eruption
- Postemergent Eruption

emergent : means to come through, to become visible in the oral cavity, to penetrate the gingiva.

After penetration of the gingiva it will undergo 4 stages for Eruption "development of the tooth "



1. Postemergent Spurt "Speed process, Accelerated level" until it reaches the occlusal level, Then It slows down to enter the next stage
2. Juvenile occlusal equilibrium "slow stage" , then it will accelerate again in the next step
3. Pubertal Spurt of Eruption
4. Occlusal equilibrium

For Permanent Teeth to erupt I need:

Bone Desorption

Deciduous Teeth Resorption

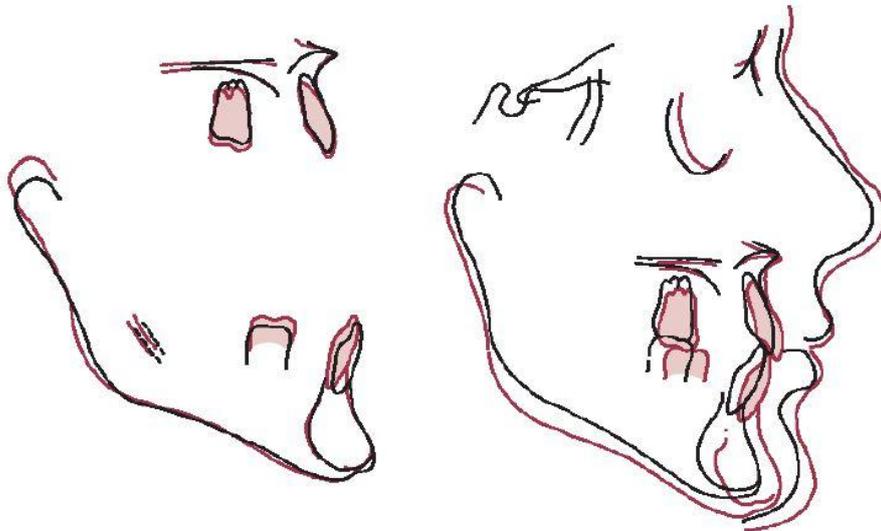
Normal Root Development of the permanent tooth "elongation.."

Normal Pulpal development " Blood supply , Nerve supply..."

Periodontal ligament Development

and No obstacles "Super numerary teeth, cyst, pathology ..."

So if this is found we will have normal preemergant eruption.



Once the tooth erupts , the tooth will be out of occlusion " partially erupted " there is no opposing forces ...so it will erupt really fast and this what we call post emergent eruption , once the tooth comes in contact with the opposing tooth it will slow down and we will have another stage of Juvenile occlusal equilibrium ..

The tooth continues to erupt because the child still erupts in the vertical dimension, so we need to compensate for this Gap "Gradually, slowly", for this we call it equilibrium "The force of eruption, the force of occlusion" and then the rate of eruption should be equal to the rate of vertical growth of the mandible.

After that

we will have the pubertal growth spurt that we have talked about in the craniofacial lectures...

So we will have sudden accelerated growth overall and that includes the growth of the tooth germ, maxilla and the mandible, so we will have another acceleration of eruption what we



call pubertal spurt of eruption.

Then we will have Occlusion and a state of equilibrium between the eruption forces and the occlusal forces.

So eruption will stay there forever, what does this mean ?

Let's say the opposing tooth has been extracted for caries or any cause , what will happen for the tooth that doesn't have opposing one ? > Over eruption, because it lost its equilibrium, so it will continue eruption until you get a bridge or something else, or until it comes in contact with the gingival on opposing arch.

The Mixed dentition

is the time the first permanent tooth starts to erupt all the way the last deciduous "primary" tooth is lost.

Chronology of Tooth Development, Permanent Dentition

Tooth	CALCIFICATION BEGINS		CROWN COMPLETED		ERUPTION		ROOT COMPLETED	
	Maxillary	Mandibular	Maxillary	Mandibular	Maxillary	Mandibular	Maxillary	Mandibular
Central	3 mo	3 mo	4½ yr	3½ yr	7¼ yr	6¼ yr	10½ yr	9½ yr
Lateral	11 mo	3 mo	5½ yr	4 yr	8¼ yr	7½ yr	11 yr	10 yr
Canine	4 mo	4 mo	6 yr	5¼ yr	11½ yr	10½ yr	13½ yr	12¼ yr
First premolar	20 mo	22 mo	7 yr	6¾ yr	10¼ yr	10½ yr	13½ yr	13½ yr
Second premolar	27 mo	28 mo	7¼ yr	7½ yr	11 yr	11¼ yr	14½ yr	15 yr
First molar	32 wk in utero	32 wk in utero	4¼ yr	3¾ yr	6¼ yr	6 yr	10½ yr	10½ yr
Second molar	27 mo	27 mo	7¾ yr	7½ yr	12½ yr	12 yr	15¾ yr	16 yr
Third molar	8 yr	9 yr	14 yr	14 yr	20 yr	20 yr	22 yr	22 yr

The first teeth start to erupt are the mandibular central incisor and the 1st permanent molar , the last tooth to erupt the 3rd Molar "wisdom" , If it is present because actually it is in large number of population is missing .

The first permanent tooth has the 1st signs of calcification is the permanent 1st molar around birth , the rest of teeth will calcify after birth ,so for ex the central incisors will calcify 3-4 months after birth ,here is a little exception the maxillary lateral incisor 11-12 months .

The eruption time differs from the calcification time, when we talk about eruption and mixed dentition there is a General rules :

Female permanent teeth erupt before males 5-6 months

Mandibular teeth erupt before maxillary teeth

If I have one tooth erupted from one side the other one in the other side will erupt within 6 months

Root calcification finishes 2.5-3 years after eruption.

The permanent teeth erupt with root , for this we divide the eruption of permanent teeth into stages , 6 stages "dental age", dental age doesn't always coincide with chronological age , pt will have +/- 1-2 standard deviation from the average.

1st-dental age 6 > we expect the mandibular central incisor and first molar to erupt

2nd stage –dental age 7 > we expect the maxillary central incisors and the mandibular lateral



incisor to erupt , but at the same time I can take a radiograph and identify the rest of the unerupted teeth , so for ex we can find the maxillary lateral incisor which hasn't erupted yet the root formation of it is advanced , canine and premolars have passed crown completion and they start root formation ... but clinically we just see incisors and lower 1st molar .
3rd stage –dental age 8,9,10 >dental age 8 where we have a maxillary lateral incisor erupted, after this the child will pass 2-3 years without eruption of any more teeth, sometimes the parents become concerned why their child doesn't get new permanent teeth and stopped losing deciduous teeth, so u reassure the parents that it's Normal, unless you have teeth on one side erupted before the other side for a period more than 6 months and you go for another investigations.

If the parents came to u with their child at dental age 8 and there is No upper central incisors and the lateral incisors in the maxilla erupted, here you will be concerned.

So Sequence of eruption is important but time of Eruption is Okay. So dental age is followed by 2-3 years of Normal eruption.

Dental age 9>Normal eruption but I can find in the radiograph one third of the roots of mandibular teeth is completed, and the maxillary teeth "the canine and the premolars and the mandibular 5 roots formation just started.

At dental age 10 normal eruption but at the radiograph I am gonna find that one half of the roots of mandibular canine and 1st premolar is completed and one half of maxillary first premolar is completed and significant root development of maxillary canine and second premolar

But Nothing clinically is significant.

4th stage – at dental age 11 I will have eruption of mandibular canine , mandiblar 1st premolar and maxillary first premolar , so in the maxilla the maxillary 1st premolar will erupt before the canine "but in the mandible we will have have 3 & 4 erupt around the same age".

5th stage > At dental age 12 e will have the 2nd premolars and the maxillary canine erupted, the 2nd molar is about to erupt at this stage "partially erupted"

6th stage 13, 14, 15> is the completion of eruption of permanent teeth and on a radiograph I should see signs of calcification of 3rd molar if it does exist, or it would be congenitally missing.

The sequence of eruption is more important than the timing itself because we have deviations , and as the teeth erupt I am gonna have a transient open bite , because the teeth are still not fully erupted , so Anterior open bite at early age of eruption of incisors is considered normal , Not to panic and just reassure your patient.

How can I accommodate large permanent incisors in the space of small primary incisors ?

We have talked about spacing, The difference between the mesio-distal width of the central incisor "which is the place required to accommodate them" in comparison to same organelle within the arch is what we call incisor liability, It means potential crowding if it exists "Tendency for crowding".

Tendency of lack of space of central incisor is what we call incisor liability , so the difference between the space required to accommodate the central incisor "the mesio-distal width of each incisor" in comparison to the space available within the arch.



The incisor liability is more in females and It's more in the mandible, so the mandibular central incisor are expected to erupt in minor crowding 1.6 mm of crowding "lack of space", so if I have a lower incisor that erupt a little bit lingually because the follicle position is actually lingually with a little bit of crowding and rotation this is considered normal within 1.6 mm –up to 2 mm because you can't be accurate clinically.

by age I expect this problem to resolve without any intervention by :

1- we are going to have primate spaces distal to the primary canine in the lower arch , so when the permanent canine erupt it will jump into the primate space leaving some space for the central incisor.

2-the transverse of the arch "width" especially to canine will increase and that will give additional 1-2 mm of space

3-The lower incisor will erupt proclined and that's give a wider arch and more space.

But if the crowding is more, maybe intervention is necessary.

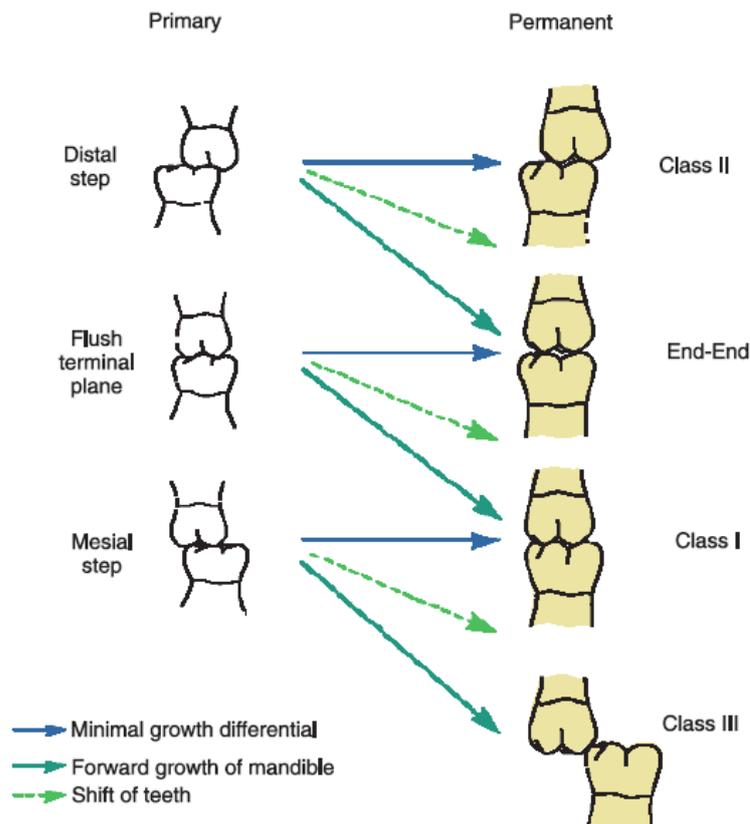
The maxillary teeth are expected to erupt spaced what we call the ugly duckling stage, Because the follicle is positioned ligually and so actually they erupt proclined so I have wide arch and because the permanent canines are actually erupting against the distal surface of the root of the lateral incisor, so they pushing the root medially and the crown will flare out, so I am going to have more spaces, so spacing between the central incisors is considered normal in the maxillary arch.



This is how the child will look like , spaced upper segment before the eruption of the canine and this's what we call and this what we call ugly duckling stage , a lot of parents come at this stage concerning about diastema , a diastema of 2 mm of the central incisors is considered normal, a little bit of spacing , a little bit of distal flaring of the central incisor is considered Normal ,because later on the canine will come through pushing the "crown" of the lateral incisor and this will close most of these spaces.

On Radiograph you see the upper canine pushing on the distal surface of the lateral incisor.





Permanent Molar Relationship:

The Normal Permanent Molar Relationship is Class I

Class I :here the Mesio-Buccal cusp of the 1st per molar in the maxillary arch occlude in the buccal groove of the lower first Molar . So This's what we call class I molar relationship.

If The Mesio Buccal cusp is ahead "Anterior" to this normal position we call it class 2 Molar relationship

If The Mesio Buccal cusp is posterior to the buccal groove of the lower first Molar we call it class III Molar relationship

Flush Terminal Planes is the Normal primary Molar Relationship , In order to get from this position to a Normal Class I molar relationship , I need the Lower move a little bit forward relatively to the upper , there 2 factors important in that :

1- Mandibular Growth , because the mandible relatively will grow more than the maxilla , and the mandible will carry the lower molar with it , so relatively it will move forward .

2-Lee way space , Is the difference between Mesio-distal width of the C D E in the primary dentition compared to 3 4 5 in the permanent Dentition , so we expect the primary canine,1st Molar & 2Nd Molar to be wider than the permanent (canine ,1st premolar,2nd premolar).

In The Maxilla Lee way space 1.5 mm in each side > total 3 mm

In The Mandible Lee way space 2.5 mm in each side > total 5 mm

So lee way space is more in the lower arch, so I expect molar will jump more mesially in the lower arch than the upper arch and this should contribute to the correction flushed terminal planes into a class I molar relationship.

Shift of teeth mesially is contributed by lee way space

Primate space used by Anterior Teeth specially the canine

lee way space used by Molar

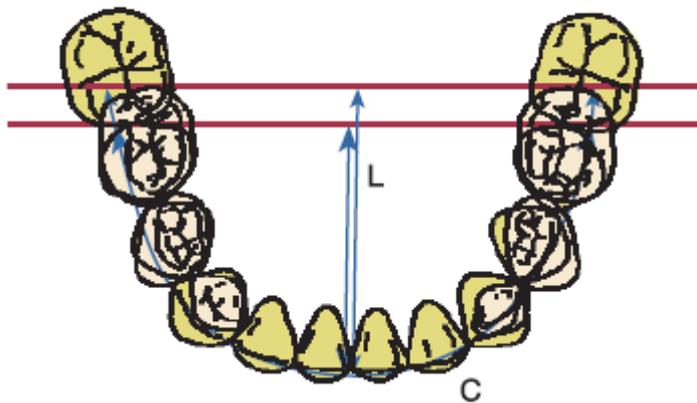
to Reach Here "from flushed terminal planes to class I molar relationship" I need good Mandibular growth and I need a nice shift of teeth using the lee way space

If I have a distal step and Not a lot of growth Then the molars will stay in the Class II molar relationship

If I have a distal step ,very good growth and Normal shift teeth , I might reach end to end or class 1 Molar relationship .

If I have a mesial step and luckily Minimum mandibular growth , no teeth shift , I can move it to class I

and this is how we move from primary molar relationship to permanent molar relationship



3. Arch changes in Dimension :

in the transverse dimension, in the primary dentition I am going to have an increase in the inter canine width 1-2 mm, By the age of 3 I will have an increase by 3 and this will resolve the problem of lower incisor crowding , by age 13 there minimal changes and after that I will have some a little of relapse "Reduction in the inter canine distance" ,Regarding the inter molar width usually 2-3 mm.

The Arch length > The line between the medial surface of the first molar all the way to the mesial surface of the permanent molar on the other side, It is usually stabilized, Not a lot of changes in the Maxilla, But in the Mandible because of lee way space we can jump forward about 4 mm and that's account for reduction in the length of the arch of the mandible.

