#Helper-team

Lec6

Tooth Eruption

Type of eruption:

Passive eruption:apical shift of gingiva (gingival recession)

ال gingiva اللى رجعت

Active eruption: is the axial or occlusal movement of the tooth or tooth germ from its development position with in jaw to its functional position in the occlusal plane

وهنا ال tooth بتحرك لفوق لل oral cavity

Type of movement:

a)Axial : occlusal movement in the direction of the long axis of the tooth

هنا اتجاه الحركه لفوق

b)Drifting or bodily movement:in distal,mesial , lingual or buccal

السنه كلها بتتحرك

c)Tilting or Tipping: movement around a transverse axis

بتتحرك على ال transverse axis لاما mesially او distally

d)Rotating:movement around a longitudinal axis

Besides,Eccentric growth leading to shift of the center(هتتشرح كمان شويه)

The phases of the tooth eruption can be divided into the following:

1. Pre-eruptive phase
2. Eruptive phase (prefunctional eruptive phase)
3. Posteruptive phase (functional eruptive phase)

(1)The pre-eruptive phase:

Start from the **end of early bell stage** till **the beginning of root formation**

مرحله اعداد للeruption يعنى مفيش ظهور لاسنان فى ال oral cavity

Historical event:

Bone resorption in side which tooth move to ward by osteoclasts

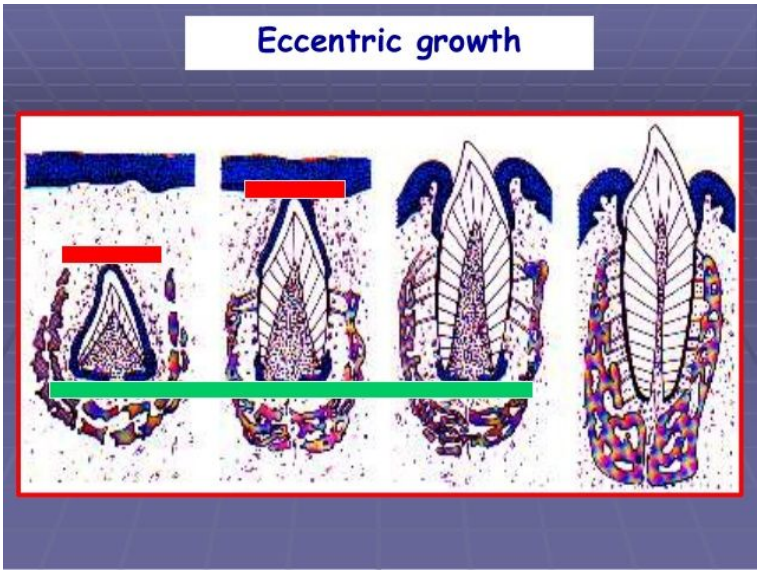
Bone deposition in other side by (behind)osteoblasts

بيحصل هدم للعضم فى الاتجاه إلى ريحاله السنة وتكوين للعضم في الناحية الابعد (الى عكس اتجاه حركة السنه)

Two patterns of movement occur in this phat:

الخمس حركات بيحصلو لكن الاتنين دول هما الى مسيطرين وتأثيرهم اوضح

a) Eccentric growth :this means that one part of developing tooth germ remains stationary (growth root)while the remainder (end of crown)continues to grow leading to a shift in its center.



معانها ان جزء من الcrownاستمر فى النمو والحركه وجزء فضل ثابت فحصل حركه للcenter

Bone resorption is seen on the surface of the crypt that faces the growing part of the tooth germ

Drifting or bodily movement: Which is a shift of the entire tooth germ that causes bone resorption in the direction of tooth movement and bone apposition behind.

نفس الى اتشرح فى historical event

•The rate of tooth movement in the pre eruptive phase is equal to the rate of growth of jaw

ده يعنى تغير فى الlength,width,height للفك هيتبعه تغير فى مكان السنه

Movement of the deciduous tooth germ

•as the infant jaw grow in **Height** ,the tooth germs move in a vestibular (up ward, occlusal) direction

• jaw growth in **width**(thickness) the tooth germ move outward (buccal and laterally)

• Jaw growth in **Length (**anterior posterior) :

1) anterior deciduous(**A,B,C**) drift **forward** (mesially)

2) first deciduous molar(**D)** still in it's location (doesn't move)

3)second deciduous molar (**E)** drift **backward** (distally)

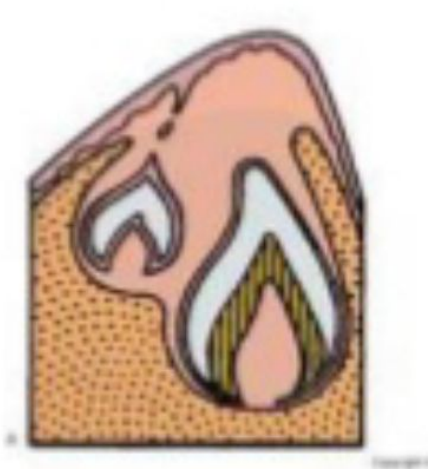
Movement of the permanent tooth germ

a)permanent incisors and canine

1)•first develop lingual to the deciduous tooth germ

• at the same level of their incisal surface

•in the same bony crypt



فى الاول بتكون ال permanent germ ورا الdeciduous germ وفى نفس المستوى وفى نفس الـ bony crypt

2)then as the deciduous predecessors start eruption,the premanents germ :

•move to more apical region of their deciduous predecessors

•and occupy their own bony crypts

Due to:

•The occlusal (axial)movement of the deciduous teeth

•The growth of the jaw in height

مع بداية الeruptionللdeciduous بيتحرك الpermanent germ لاتجاه اسفل ال deciduous وبيكون ليها bony crypt خاص بيها وده بسبب حركه الdeciduous لفوق ونمو الفك

b)permanent premolars:

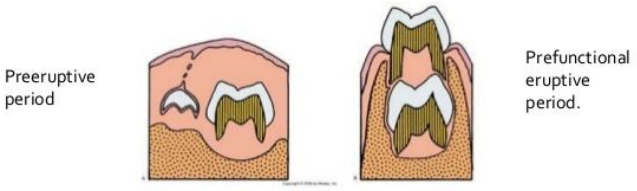
1)begin their development lingual to their predecessor

•at the level of their occlusal surface

•at the same bony crypt

2)then permanent germ found in between the divergent root

•and at end of the pre eruptive it become in own bony crypt below the divergent root of deciduous molar (the predecessor)

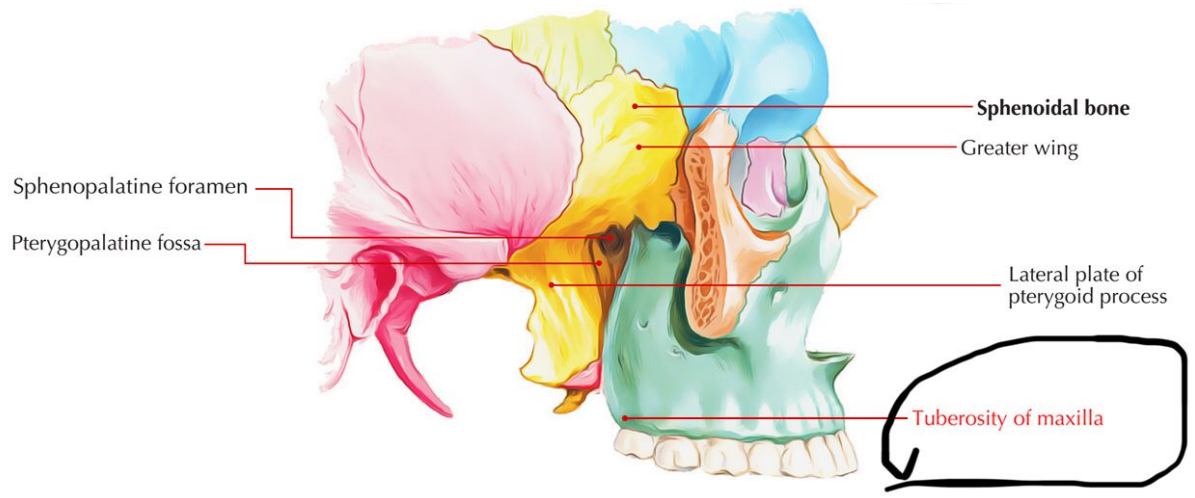


c) permanent molar germs :

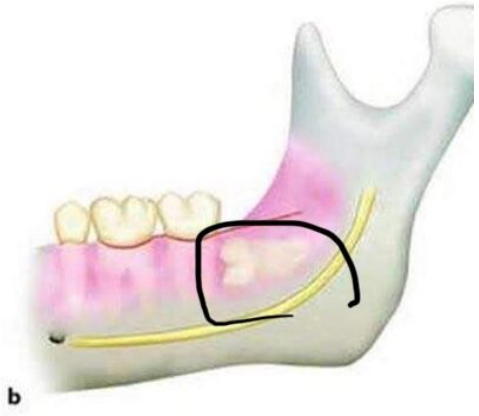
1)upper molar develop in the tuberosities of the maxilla with occlusal surface facing distally.

They swing around only when the maxilla has grown to provide the necessary space

يعنى الupper permanent germ بيكون مايل فى اتجاه الdistal عشان لسه الjaw صغير ومفيش مكان كافى لكن لما بيكبر الفك بيلف الmolar لاتجاه الطبيعى



2)lower molars develop in base of mandible rami and occlusal surface facing mesially.
They become upright as room becomes available



هنا بردو نفس الفكره مساحه الفك صغيره فالlower molar germ بيكون الocclusal surface بيكون مايل بس هناmesially

The change in axial relationship between deciduous and permanent teeth is due to:
•The occlusal (axial)movement of the deciduous teeth
•The growth of the jaw in height

2) Eruptive phase:

♦ It begins with the root formation and ends when the tooth appears in the oral cavity, just before function. The tooth moves to its functional position in occlusion.

يعني السنة وصلت لل occlusal plane بس لسه ماعملتش proper occlusion with its antagonists .

♦ The rate of tooth eruption is more than the rate of jaw growth. (that's why the tooth appears in the oral cavity).

Histological events:

1) Root formation
2) PDL formation: development and organization of PDL fibers
3) Development of dentogingival junction

- **Root formation:** بيحصل على 3 خطوات علشان المرحلة طويلة

a) The roots grow first toward the floor of the bony crypt which result in **bone resorption** to provide room for the growing root.

b) When the tooth appears in the oral cavity, **resorption stops and bone deposition begins** on the crypt wall or at the crest of interradicular septum (in multirooted teeth).

لو مفيش deposition اي خبطة فالسنة قبل ال functional eruption ممكن توقعها.

c) When the tooth reach the occlusal plane, **the root formation is not yet complete, and its growth continues by removal of bone on socket floor.**

بيحصل resorption تاني وبيقف ويحصل deposition برضو تاني زي الأول.

♦ Root completion continues for a considerable time after the teeth have been in function (**From 1-1.5 years for primary teeth, and from 2-3 years for permanent teeth**).

Significant changes occur in the tissue covering the erupting tooth:

لازم نعرف ان السنة وهي قاعدة فال bony crypt بتاعها بيكون في عوائق بينها وبين انها تطلع وتظهر فالoral cavity والعوائق دي هي:

-Bone

-Epithelium

-Connective tissue separating them

وهنعرف كل واحدة ايه اللي بيحصلها:

♦ The tooth moves occlusally and bone resorption of the overlying bony crypt occurs by **differentiation of osteoclasts.**

♦ By certain enzymatic action (**Desmolytic enzyme**), there is loss of the intervening connective tissue between the reduced dental epithelium covering the crown and the overlying oral epithelium.

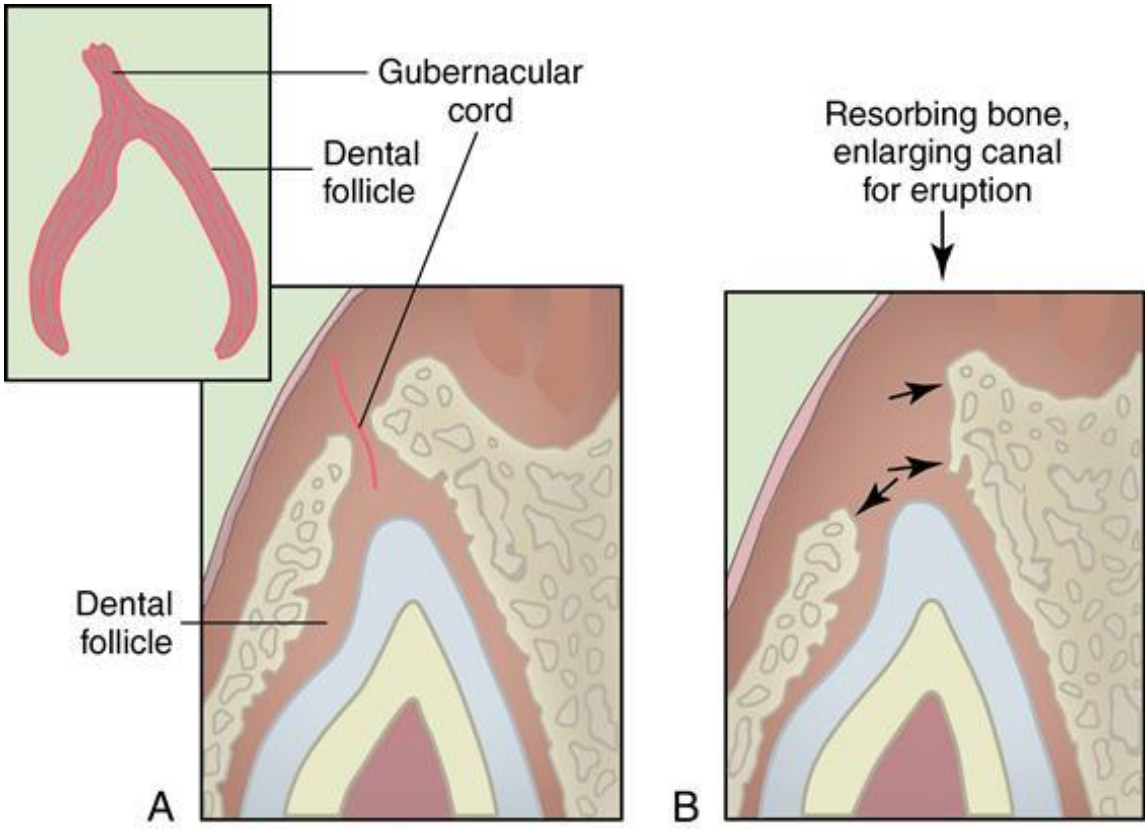
♦ The two epithelia (reduced dental epithelium and oral epithelium) fuse together forming a central mass of epithelial cells. The central cells of this mass degenerate (because it's avascular) and form an **epithelial lined canal** through which the tooth erupts without any haemorrhage and dentogingival junction is formed.

الأسنان لما بتطلع مابينزلش دم وده بيكون بسبب ال epithelial lined canal .

 كل اللي فوق ده بتاع ال deciduous او ال non-succedaneous permanent teeth

- As the deciduous tooth erupts, the permanent tooth germ becomes situated apically and entirely enclosed by bone except for a small canal containing **remnants of dental lamina and connective tissue.** This canal is **gubernacular canal** (bony tissue) and the soft tissue inside is **gubernacular cord**. This cord acts as a guidance for the permanent tooth as it erupts.

بيكون lingual للسنة الdeciduous فالanterior وبيبقى in socket space بتاعت ال posterior.



♦ Eruption is a gradual and intermittent process (شوية تقف وشوية تشتغل)

♦ The principal direction of movement is occlusal or **axial.**

♦ As mentioned before, in this phase the tooth appears in the oral cavity because the rate of tooth eruption is more than the rate of jaw growth.

3) Post eruptive phase:

♦ It begins when the teeth reach the functional position (proper occlusion) and continues for as long as each tooth remains in the oral cavity (until loss).

♦ The principle movement is in an **axial** direction to compensate and keep pace with the increase in height of the jaws, and to reach its functional position.

♦ Jaw growth occurs most actively between the ages of **14-18 years**.

(بعد 3 سنين من الroot formation لأي سنة)

♦ There is active bone deposition at the base of the socket, crypt wall, alveolar crest and the crest of the interradicular septum in multirooted teeth.

السنة عمالة تطلع، فبالتالي العظم بيتكون اكتر حوالين الroot .

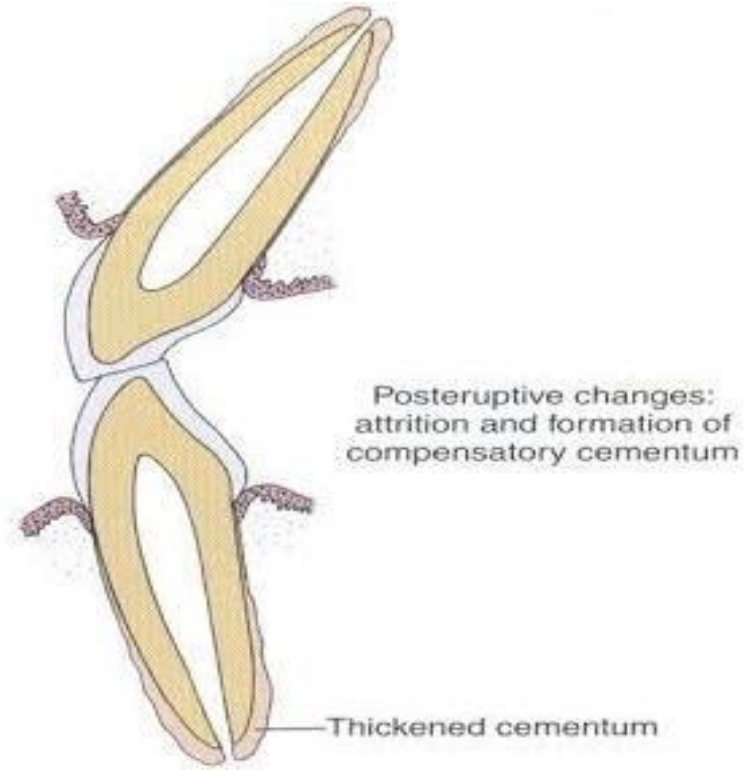
♦ More organization of the principal fibers of the PDL occurs and they establish themselves into separate groups.

الfibers ظهرت فالeruptive phase عادي لكن هنا هما قسمو نفسهم لجروبات منفصلة اللي هما dentogingival, dentoalveolar and transseptal fibers .

♦ Arteries (blood supply) and nerves are established in the PDL in this phase.

♦ In this phase the tooth makes movements to compensate for occlusal and proximal attrition. If it's occlusal, the tooth will move in an axial or occlusal position by hypercementosis on the apical third of the root. If it's proximal, **mesial or proximal drift** takes place to maintain sharp contact of the teeth.

احنا قولنا ان ال active period of jaw growth بتكون بين ال14 ل18 سنة، ليه بقى الphase دي بتستمر طول ما السنة موجودة ومابتخلصش مثلاً بعد ال18 ؟ علشان الاسنان بيحصلها attrition ولازم اعوضه عن طريق ان السنة تتحرك يا أما occlusal او proximal على حسب هو حصل فين وبعد كده بيحصل hypercementosis زي ما خدنا الترم اللي فات.



♦ This shift is seen as a selective deposition and resorption by osteoblasts and osteoclasts respectively. **Deposition occurs in the distal wall** of the sockets, while **resorption occurs in the mesial wall.**

- Types of post eruptive movements (as mentioned above in details):
  - Axial or occlusal movement to compensate jaw growth
  - Axial or occlusal movement to compensate occlusal attrition
  - Mesial or proximal drift to compensate proximal attrition

Mechanism of tooth movements (Series of eruption):

- Only **4** theories met much considerations out of many :

1) Root formation theory:

♦ This theory assumes that proliferating root develops against a fixed base that converts an apically directed force into occlusal movement.

الfixed base عاملة زي الارض كده والroot عامل زيك لما تيجي تنط بتدي قوة لتحت فتتحول القوة دي لفوق وتنط. وطبعاً الbase لازم تكون hard علشان ماتخدكش وتقعو انتو الاتنين.

♦ Root formation is unlikely the cause of tooth eruption because:

a) The growth of the root requires the presence of a fixed base to result in an eruptive force. The structure known as **Cushioned-hammock ligament** before and was believed to be a fixed base for the growing root to react against, is now proven to be the pulp delineating membrane that run across the apex (soft tissue).

b) The onset root formation does not coincide with the eruptive movement (The eruptive movement can occur after root formation completion).

الpre-eruptive phase بتحصل قبل بداية الroot formation والpost eruptive phase بتحصل بعده، فبالتالي الroot formation مش هو المسؤول عن الeruption .

c) Some teeth move a greater distance than the length of their roots.

d) Experimental resection preventing further root formation does not stop eruptive tooth movement.

بعد ما العلماء تعبو وفكرو علشان يشوفو النظرية دي صح ولا غلط، جيه واحد من غير ما يتعب دماغه قالهم احنا نشيل الroot ونمنع تكوينه ونشوف هل الeruption فعلاً بيعتمد عالroot formation وهيقف لما نشيل الroot ولا هيفضل شغال. اللي حصل ان الeruption ماوقفش وفضل مكمل عادي.

2) Bone remodeling theory:

♦ It was proposed that selective deposition and resorption of bone are responsible for eruption.

♦ Experimental works establish the absolute requirement for a dental follicle to achieve bony remodeling and tooth eruption, because it provides the source for new osteoblasts and osteoclasts derived from monocytes through its vascular supply. (if the dental follicle is removed, no eruptive pathway forms).

♦ It is not known whether the bony remodeling causes or is the effect of tooth movement.

حاولو يشوفو النظرية دي صح ولا غلط عن طريق انهم يأثرو على ال dental follicle و ال monocytes بتوعها علشان دول اللي بينتجو ال osteoblasts and osteoclasts ويشوفو هل ال eruption هيتأثر ولا لأ. اللي حصل ان السنة اتحركت لكن ال eruption اتأثر برضو ، ده معناه ان ليهم دور فال eruption لكن مش هما السبب الرئيسي.

3) Vascular pressure theory:

♦ It proposes that a local increase in tissue fluid pressure in the periapical region is sufficient to move the tooth.

بما ان اعلى ضغط دم وأعلى معدل ضخ للدم فالجسم بيكون عند ال pulp ، وعلشان في فرق بين ضغط الدم بين ال apical and occlusal parts of the teeth ، قالو ان يمكن يكون هو ده السبب اللي بيخلي السنة تتحرك ويحصلها eruption.

♦ Experimental elimination or isolation of the periapical vasculature does not prevent tooth eruption.

♦ Tissue fluid pressure as an eruptive force must be considered, as pressure differential exists below and above an erupting tooth has been reported.

لما وقفو ضخ الدم للسنة، لقو ان ال eruption اتأثر، بس فضل شغال. يعني ليها دور برضو لكن مش هي السبب الرئيسي.

4) Periodontal ligament traction theory: (most accepted theory)

♦ It proposes that the cells and fibers of the PDL pull the tooth into occlusion.

قالو ان ال cells بيحصلها contraction وال fibers بتفرد نفسها لفوق كأنها حبل وبيتشد لفوق فالسنة بتطلع in occlusal direction .

♦ It is biologically the most accepted theory as isolated fibroblasts have been shown to have contractile properties (fibroblasts of PDL, unlike all other fibroblasts, have actin and myosin) and also responsible for the contraction that occurs during wound repair .

♦ The contraction force initiated by the fibroblasts is transmitted to the extracellular compartment (the PDL fibers) via **fibronexuses.**

- **Mechanism of eruption is multifactorial.**

PDL traction theory كذا factor مع بعض بس بنسب مختلفة. اعلى نسبة بتكون لل

Posteruptive tooth movement:

♦ In posteruptive movement, axial movement of the tooth during eruption is also used to compensate for occlusal wear.

♦ Mesial or proximal drift involves the a combination of two separate forces resulting from:

1) Occlusal contact of teeth اللي قصاد بعض بيزقو بعض
2) Contraction of the transseptal ligaments between teeth, which also has a key role in maintaining tooth position.

Shedding

Shedding is the physiologic loss of the deciduous teeth as a result of resorption of their root and supporting tissues.

هو فقدان الاسنان اللبنية بشكل طبيعي بسبب التآكل لجذور الاسنان و الانسجة المحيطة بيها.

-This occurs in order to allow deciduous replacement by permanent teeth.

-There is another set of teeth that is larger in size because :

- jaws increase in size while teeth don't

- masticatory forces increase

ربنا عمل اسنان لبنية و بعدين اسنان دائمة ، و دا علشان يلائم حجم الفك بعد النمو ، و يلائم حجم قوى المضغ الكبيرة.

Pattern of shedding: خطوات

—بسبب ال pressure الناتج عن الاسنان ال permanent دا بيخلي الخلايا اللي حولين ال root انها تتحول ل **odontoclast** اللي بتاكل الroot.

طيب مكان ال ضغط دا بيكون فين؟

دا بيتحدد بمكان ال pressure و بيختلف على حسب السنة anterior او posterior:

*Anterior teeth:

The permanent tooth germ begins to exert pressure **lingually** , then **apically**. Because of vestibulobuccal movement of permanent germ.

زي ماقولنا ان الاسنان الpermanent موجودة lingual و بعدين apical و دا بيخلي الخلايا اللي حولين الroot انها تتحول ل **odontoclast** اللي بتاكل الroot.

*Especially in mandibular incisors (1,2), permanent teeth erupt before taking the apical position , so the permanent teeth erupt lingual to the deciduous .

ممكن السنة تطلع قبل ماتاخد المكان الapical و بالتالي هتطلع السنة و تظهر lingual للسنان ال deciduous

*Posterior teeth:

The premolars exert pressure first , **in between the roots** (on inner surface), then the deciduous tooth moves upward so the pressure will be **apical**.

في الاول بيكون الpremolars مكانهم lingual لكن الضغط اللي بيبذلوه بيبقى ضعيف ، لكن بعد ما يوصل و يكون in between the roots يحصل resorption لل root ، و بعد كدا السنة بتتحرك لفوق بسبب زيادة ارتفاع الفك و بالتالي ال premolar بيكون apical لل deciduous .

Note:

Early resorption of the deciduous molars are repaired by deposition of cementum-like tissue.

في pressure بيحصل بدري قبل ما يجي وقت ال shedding فبيعمل resorption بس بيتصلح

❖ Histology of shedding:

The cell responsible for the resorption is **odontoclasts**.

- They are large, multinucleated cells (6-12)
- They are originating from blood monocytes
- occupying “Howship’s lacunae”.
- They have processes called ruffled borders , with clear zone peripheral to it.
- The clear zone doesn’t contain any organelles except actin and myosin proteins that fix the cells with the resorping surface.
- The cytoplasm is eosinophilic , rich in mitochondria , lysosomes and large golgi complex.
- They contain small amount of RER.

After resorption, they stay in root canal , or pulp chambers.

-The process of resorption is intermittent(not continuous) so that repair occurs by cementum-like tissue.

العملية دي بتحصل على فترات متقطعة ، بيحصل repair اثناء فترة الراحة ب cementum-like tissue او ب less mineralized cementum

❖ Mechanism of resorption:

Resorption can be initiated by:

■ Pressure from permanent teeth

■ Increased forces of mastication

A) pressure from permanent teeth

It causes **odontoclasts** differentiation and starts resorption

B) forces of mastication

- as the person grows, the force of mastication increases due to growth of muscles
- This force becomes too high for the pdl and causes weakness of the supporting system
- This leads to initiation of resorption

عشان كده حتى لو مفيش سنة permanent السنة ال deciduous هتقع بردو

-This occurs through,demineralization of inorganic part, disaggregation of organic part, and elimination of these products to the bloodstream.

-Fibroblast take a role in degradation of organic part.

-In case of PDL, it's cells undergo **apoptosis** which is a programmed cell death. This causes weakness for the supporting system of the tooth.

الخلايا بيبدأ عمرها ينتهي و تموت و بالتالي يضعف الPDL

-Pulp stays vital until shedding occurs (الطفل بيفضل حاسس حتى قبل ما تقع السنة)

***Clinical Considerations:**

1-Remnants of deciduous teeth:

They are parts of the roots of deciduous teeth that have escaped shedding and remained in the jaws.it's most common in lower 5 due to its strong curve يعني جزء من السنة اللبنية بيفضل موجود بعد ما بتقع

- The fate of these remnants:

a- become surrounded by bone (ankylosis)

b- become surrounded by cellular cementum

c- become close to the surface and exfoliated

d- undergo resorption

2- Retained deciduous teeth:

This is due to:

1- Congenital missing of permanent teeth

Its most frequent in upper 2 , then lower 5 , then lower 1

السنة الدائمة ماتكونتش اصلاً فبتفضل ال deciduous موجودة

2- Due to impacted permanent teeth

السنة اتكونت بس مدفونة فمش بتطلع و مبتعملش pressure على ال deciduous

3- supernumerary tooth or odontogenic tumor (no space for permanent)

تعدد الاسنان او ورم بيمنع السنة الدايمة من ان يحصلها eruption

*the fate of the retained deciduous teeth:

1- persist in oral cavity in good function

تستمر

2- Shedding as a result of excessive occlusal forces

زي ما قلنا في اسباب ال shedding

3-Submerged deciduous teeth:

-Trauma to the deciduous teeth can cause bone deposition around the tooth and prevent shedding (ankylosis)

لو حصلت اصابة للسنة اللبنية ، بيتكون عليها bone يمنعها من ان يحصلها shedding و يمنع السنة المستديمة من الطلوع.

-They must be removed surgically to allow the eruption of the permanent tooth