Pediatric Dentistry

4 th Year

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Eruption of teeth

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Pediatric Dentistry

An age-defined specialty that provides both primary and comprehensive preventive and therapeutic oral health care for infants and children through adolescence, including those with special health care needs.

Pedodontics: is a branch of dentistry that is concerned with the dental care of children its origin came from a Greek wards (pedo-child + odous, odont- 'tooth').

Eruption of teeth

This process can be defined as the movement of the tooth through the tissues of the jaw towards occlusion into the oral cavity. The formation and eruption of teeth are two essential processes which may be influenced by?

Dentition → **primary**

→ **Permanent**

** Each tooth starts to move toward occlusion at approximately the time of crown completion, and the interval from crown completion and the beginning of eruption until the tooth is in full occlusion is approximately 5years for permanent teeth.

Pattern of tooth movement

A considerable movements are required to bring the teeth to the occlusal plane and then into functional occlusion.

Types of tooth movements:

1. **Pre- eruptive tooth movement:** includes all movements of the deciduous and permanent tooth germs within the tissues of the jaw, from the time of early initiation

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and formation to the time of crown completion and this phase terminates with the initiation of root development, during this phase the growing tooth moves in two directions to maintain its position in the expanding jaws (outward and upward in the mandible and outward and downward in the maxilla).

Bodily movement: it occurs continuously as the jaw grows by which the movement of the entire tooth germ cause bone resorption at the direction of tooth movement and bone apposition behind it.

Eccentric movement: one part of the tooth germ remains fixed while the rest continues to grow causing a shift in the center of the tooth germ.

****The root elongates when the crown does not increase in size.**

2. **Eruptive tooth movement:** it is the axial movement of the tooth from its crypt within the bone of the jaw to its functional position in occlusion (to occlude with its antagonist).
3. **Post – eruptive tooth movement:** it occurs primarily to maintain the position of the erupted tooth while the jaw continues to grow and to compensate for the occlusal and proximal wear. This movement occur in axial direction.

Theories of tooth eruption

1. **Root formation:** It was believed that root formation is an obvious cause of tooth eruption because it causes an overall increase in length of the tooth that must be accommodated by the growth of the root into the bone, an increase in jaw height or by the occlusal movement of the crown (eruption). Root growth theory suggested the presence of the cushion hammock ligament at the base of the socket that transmits the force to cause eruption but the ligament was never found histologically.

   Why this theory is weak?
2. **Bone remodeling:** An inherent growth pattern of the maxilla and mandible supposedly moves teeth by selective deposition and resorption of bone.

   This theory is not accepted. Bone resorption and formation occurred because of eruptive forces applied by tooth over the bone (there are some animal studies showed that bony remodeling occurs around the dental follicle regardless of the presence of a tooth).
3. **Vascular pressure:** The Vascular Pressure theory supposes that a local increase in tissue fluid or blood pressure in the periapical region is sufficient to move the tooth (States that "the tissue pressure apical to the erupting tooth was greater than

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occlusally, theoretically generating an eruptive force"). It means that the hydrostatic pressure on top of the tooth is less than hydrostatic pressure underneath the tooth. This difference in pressure will push the tooth occlusaly.

However, since surgical excision of the growing root and associated tissues eliminates the periapical vasculature without stopping eruption, this means that the local vessels absolutely are not necessary for tooth eruption.

4. **Periodotal ligament:** Eruptive force resides in the dental follicle-periodontal ligament complex. Formation and renewal of the PDL has been considered a factor in tooth eruption because of the traction power that fibroblasts have which may pull the tooth out during eruption.
"The periodontal ligament, which is derived from the dental follicle, provides the force required for eruption mainly by fibroblast contraction"
HOWEVER, in vitro tissue studies have limitations concerning this theory.

5. **Dental follicle theory:** It is clear that the dental follicle is essential to achieve the bony remodeling required to accommodate tooth movement, for it is from this tissue that the osteoblasts differentiate.
Note: Studies have shown that the reduced dental epithelium initiates a cascade of intercellular signals that recruit osteoclasts to the follicle. By providing a signal and chemoattractant for osteoclasts, it is possible that the dental follicle can initiate bone remodeling which goes with tooth eruption. Teeth eruption is delayed or absent in animals models and human diseases that cause a defect in osteoclast differentiation

Summery



Root Formation Theory

"Depend on the idea that root elongation is the motive force behind tooth eruption"



- **Rootless teeth can erupt**
- **Teeth still erupt after completion of root formation**
  - **Some teeth erupt a greater distance more than the total length of their root**

Bone Remodeling Theory

"Depend on the idea that Bone remodeling that achieved by osteoclast & osteoblast around an erupting tooth are the motive force behind tooth eruption"



- **Bone formation occurs after the tooth has been moved**
- **THUS it is a result, not a cause of this process**

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PDL traction Theory

"Depend on the idea that Migration & traction of PDL fibroblasts are the motive force behind tooth eruption; Tooth movement is brought about by: 1) Fibroblast contractile properties. 2) Connection with extracellular collagen fibers "fibronexus (imp. In transmitting traction to the extracellular matrix)" 3) Oblique alignment of PDL collagen fibers"



- **Rootless teeth can erupt**
- **Impacted teeth with a well-developed PDL cannot erupt**

Vascular Pressure Theory

"Depend on the idea that Vascular tissue hydrostatic pressure within the PDL is the motive force behind tooth eruption."



- **Eruption can also occur independently of the vascular alteration**



What actually happens when the tooth is erupting, there are certain genes codes certain proteins binds to certain cells of the dental follicle stimulating these follicle to differentiate into osteoclasts and osteoblasts where bone resorption and bone apposition occurs on both surfaces of the tooth occlusal and apical, this actually will cause the tooth to erupt. Therefore, the dental follicle is mainly responsible for the process of eruption.

Development of teeth

Tooth development or odontogenesis is the complex process by which teeth form from embryonic cells, grow, and erupt into the mouth (starts as early as 28 days of IUL and continues to the end of eruption of permanent molars). For human teeth to have a healthy oral environment, all parts of the tooth must develop during appropriate stages of fetal development. Primary (baby) teeth start to form between the sixth and eighth week of prenatal development, and permanent teeth begin to form in the twentieth week. If teeth do not start to develop at or near these times, they will not develop at all, resulting in hypodontia or anodontia. Development of teeth passes through the following stages:

A. Development in the prenatal period: in this period three overlapping phases occur:

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1. **Beginning of the deciduous dentition development**

The development of teeth starts at 3rd week of IUL, then the odontogenic epithelium proliferates in the 5th week to form the dental lamina which form invaginations that develop into tooth buds.

2. **The formation of the successional lamina**

It is the lingual extension of the dental lamina develops in the 5th months of IUL (permanent central incisor) to 10th months of age (2nd premolar).

3. **Initiation of the permanent dentition**

It is initiated in the 4th month of IUL.

B. Status of development at birth: the teeth are in different stages of development at birth.

C. Development in the postnatal period: it shows completion of the crowns of all primary teeth and initiation of root formation. The permanent teeth continue to develop in different stages till their root formation is completed.

Life cycle of the tooth

A number of physiological changes take place in the progressive development of teeth:

1. Growth:

a) **Initiation (bud stage):** first stage of tooth development occurs around 6-7 weeks IUL. One of the earliest signs in the formation of a tooth that can be seen microscopically is the distinction between the vestibular lamina and the dental lamina. The dental lamina connects the developing tooth bud to the epithelial layer of the mouth for a significant time.

- In this phase the location of teeth are established with the appearance of tooth germs (tooth buds) in both jaws (mandible and maxilla) to form primary teeth.

- *So if any problem occurs at this stage or any interruption happened what do you think the outcome will be?*

b) **Proliferation (cup stage):** second stage of development known as the cap stage. It results from cellular division and multiplication of cells. Because of unequal growth in the different parts of the bud, a cap is formed. A shallow invagination appears on the deep surface of the bud. The peripheral cells of the cap later form the outer and inner enamel epithelium.

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*** As with a deficiency in initiation, a deficiency in proliferation results in failure of the tooth germ to develop and in less than the normal number of teeth.

Excessive proliferation of cells may result in epithelial rests. If the cells become more fully differentiated or detached from the enamel organ, they produce enamel and dentin, which results in an odontoma or a supernumerary tooth. The degree of differentiation of the cells determines whether a cyst, an odontoma, or a supernumerary tooth develops.

c) **Histodifferentiation:** The epithelium continues to invaginate and deepen until the enamel organ takes on the shape of a bell, during this stage there is a differentiation of the cells of the dental papilla into odontoblasts and of the cells of the inner enamel epithelium into ameloblasts. Histodifferentiation marks the end of the proliferative stage as the cells lose their capacity to multiply. This stage is the forerunner of appositional activity. Disturbances in the differentiation of the formative cells of the tooth germ result in abnormal structure of the dentin or enamel. One clinical example of the failure of ameloblasts to differentiate properly is amelogenesis imperfecta. The failure of the odontoblasts to differentiate properly, with the resultant abnormal dentin structure, results in the clinical entity dentinogenesis imperfecta.

d) **Morphodifferentiation:** At this stage, the shape of the teeth is determined. The formative cells are arranged to outline the form and size of the tooth. This process occurs before matrix deposition. The morphologic pattern of the tooth becomes established when the inner enamel epithelium is arranged so that the boundary between it and the odontoblasts outlines the future dentinoenamel junction.

-So if any disturbance happened what do you think the outcome will be?

Disturbances and aberrations in morphodifferentiation lead to abnormal forms and sizes of teeth. Resulting conditions include peg-shape laterals, microdontia, macrodontia, dens evaginatus, dens invaginatus), other types of microdontia, and macrodontia.

e) **Apposition:** appositional growth is the result of a layer-like deposition of a nonvital extracellular secretion in the form of a tissue matrix. This matrix is deposited by the formative cells, ameloblasts, and odontoblasts, which line up along the future dentinoenamel and dentinocemental junction at the stage of

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morphodifferentiation. These cells deposit the enamel and dentin matrix according to a definite pattern and at a definite rate.

Any systemic disturbance or local trauma that injures the ameloblasts during enamel formation can cause an interruption or an arrest in matrix apposition, which results in enamel hypoplasia. Hypoplasia of the dentin is less common than enamel hypoplasia and occurs only after severe systemic disturbances.

f) **CALCIFICATION:** This process starts between 14 and 16 weeks of intrauterine life for primary teeth. Calcification (mineralization) takes place following matrix deposition and involves the precipitation of inorganic calcium salts within the deposited matrix. The process begins with the precipitation of a small nidus, and further precipitation occurs around it. The original nidus increases in size by the addition of concentric laminations. There is an eventual approximation and fusion of these individual calcospherites into a homogeneously mineralized layer of tissue matrix.

Notes:

- It begins in cusp tips and incisal edges of teeth and continues cervically.
- Very sensitive process that takes place over a long period.
- If the calcification process is disturbed, there is a lack of fusion of the calcospherites. These deficiencies are not readily identified in the enamel, but in the dentin, they are evident microscopically and are referred to as interglobular dentin.
- Any disturbances during the period of pregnancy as early as 14 or 16 weeks in utero might result in disturbances or anomalies in child's teeth as soon as the primary teeth erupt.

2. **Eruption:** includes two processes intrabony phase and intra oral phase. They take 5 years to be completed. The tooth emerge when ¾ its root formation has occurred. The tooth usually reaches the occlusal plane before its root development is completed, the teeth of girls erupt earlier than that of boys. When the tooth is not fully formed its root shape is funnel shaped.
3. **Attrition:** a physiological process characterized by wearing of a tooth during tooth - to - tooth contact as in mastication. The surfaces involved are incisal,

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occlusal and proximal. Basically, attrition is an aging process and it continues throughout the life.

Important

What are the importance of the eruption time?

INFLUENCE OF PREMATURE LOSS OF PRIMARY MOLARS ON ERUPTION TIME OF THEIR SUCCESSORS

1. In children who lose primary molars at 4 or 5 years of age and before eruption of the premolar teeth will be delayed.
2. If extraction of the primary molars occurs after the age of 5 years, there is a decrease in the delay of premolar eruption.
3. At 8, 9, and 10 years of age, premolar eruption resulting from premature loss of primary teeth is greatly accelerated.

Premature loss of teeth associated with systemic disease usually results from some change in the immune system or connective tissue. The most common of these conditions appears to be hypophosphatasia and early-onset periodontitis.

Try to answer:

Q: Why we have two sets of teeth?
Q: What are the other names of the primary teeth?



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