Eruption and eruption disorders
Objectives

• Discuss the physiology of tooth eruption.
• Identify the causes of anomalies associated with tooth eruption.
Introduction

• Tooth eruption refers to the movement which carries a tooth from its developmental position through the jaw tissues into its functional position in the oral cavity.

• This functional position tends to change throughout life because eruption is a continuous process.
• There are three phases of eruptive movement namely pre-eruptive, eruptive and post eruptive tooth movement.
• These movement take place during the development of both the primary and permanent teeth.
Pre-eruptive tooth movement

- This movement is made within the tissues of the jaw before they appear in the oral cavity.
- There are two types of movement that takes place:
  - *Bodily movement* of the tooth germ which allows the tooth germ to align within the dental arch
  - *Eccentric movement* results from eccentric growth of the tooth wherein one part of the tooth germ remain fixed while the rest continues to grow. This results in movement around the axis of the tooth germ.
Pre-eruptive tooth movement - 2

- During bodily movement, bone remodelling takes place: there is bone resorption in the direction of tooth germ movement and bone deposition behind.
- However, during eccentric movement, there is only bone resorption in the region of growth to make room for the change in size of the tooth germ.
Eruption movement

• This is the movement that takes the tooth from its position within bone to its functional position in the oral cavity.

• This movement is in the axial/occlusal direction. There are various hypothesis with respect to the eruption movement.
Hypothesis

• Root growth.
• Vascular pressure: proliferation of the connective tissue in the dental papilla produces the needed pressure for eruptive movement.
• Bone growth.
Hypothesis - 2

- Constriction of the pulp: with tooth development and dentine deposition, there is pulpal constriction which produces the needed pressure to effect occlusal tooth movement.
- Pulp growth.
- Periodontal ligament pull.
Acceptable theory

- The periodontal pull theory remains the most acceptable theory. While the other 5 theories describes a push approach, this theory defines a pull approach to eruptive movement.
- The theory postulates that the tooth is pulled into occlusion by the cells and or fibres of the periodontal ligament due to contractile forces of the fibroblasts.
Acceptable theory - 2

- While this theory has not been proven, evidence points to the possible substantiation of the theory because interfering with the collagen synthesis slows down or completely stops eruption of the teeth.
Physiological process of tooth eruption

• The axial or occlusal movement of the tooth starts soon after root formation begins.
• The crown of the tooth is covered by reduced enamel epithelium and as the tooth moves in the axial direction, there is bone resorption of the overlying bone and breakdown of the overlying connective tissue and mucosa.
Physiological process of tooth eruption - 2

- As the tooth gets close to the surface, the REE fuses with the oral epithelium to form a solid knot of epithelial cells over the crown of the tooth.
- Shortly after this, the central cells of this mass of epithelium degenerates and forms an epithelial canal though which the crown of the tooth erupts.
Physiological process of tooth eruption - 3

• As the tooth pierces the oral epithelium, the fused epithelial cells of both the REE and oral epithelium forms the dentinogingival junction.
Physiological process of tooth eruption - 4

- Antigens from the oral cavity passes through the widened intracellular spaces of the oral epithelium into the deeper tissues as the tip of the cusp emerges, initiating an inflammatory response within the altered connective tissue. This causes the observed signs and symptoms of inflammatory called teething.
Eruption disorders

- Teething
- Natal and neonatal teeth
- Premature eruption
- Eruption cyst/eruption haematoma
- Supernumerary teeth
- Infraocclusion
- Eruption sequestrum
- Ectopic eruption
Teething

Some believe teething is associated with local irritation, which in some cases could interfere with the child’s sleep, swelling of the gingiva over the erupting tooth, patches of erythema on the cheeks, general irritability and crying, loss of appetite, sleeplessness, increased salivation and drooling, increased thirst, circumoral rash. However others do not believe.
A systematic review of the literature showed that no evidence is available to suggest that there are any symptoms or signs specific to teething that allow a diagnosis to be made confidently in a child without excluding other organic pathology.
More recently, a clinical study showed that irritability, increased salivation, runny nose, loss of appetite, diarrhea, rash, and sleep disturbance were associated with primary tooth eruption. However, severe signs and symptoms, such as fever, could not be attributed to teething.
Teething - 4

Normal developmental process makes interpretation of research on teething more challenging.

- Normal salivary gland development which occurs at about 2 to 3 months of age; the salivary glands of infants begin functioning thus, contribute to constant drooling and may be misinterpreted as a sign of teething.

- Night waking occur around 8 or 9 months of age, when infants develop a sense of object permanence and call out to their parents at night.
Teething - 5

- Night waking occur around 8 or 9 months of age, when infants develop a sense of object permanence and call out to their parents at night.
At about 6 months of age when the primary teeth are about to erupt, the maternal antibodies in the child begins to decrease while the child builds up own antibodies which is not sufficient enough to defend the child against infections.
At this same age, the child starts crawling, picks up objects and explore with the mouth. This predisposing to gastrointestinal disturbance such as diarrhea, vomiting with associated increase in temperature. This systemic disorder may be erroneously tagged teething.
There is also the possibility that symptoms related to teething might actually result from undiagnosed herpetic gingivostomatitis.
Natal and neonatal teeth

- Natal teeth are teeth found in the mouth at birth. They are often supernumrary teeth.
- Neonatal teeth are teeth that erupt into the mouth within 6 weeks of birth. These teeth may be part of the normal dentition.
Normal eruption time

- By 30 months, all the deciduous teeth should have erupted while by 13 years, all the permanent teeth exclusive of the third molar should have erupted.
- Root formation of the primary tooth is completed by 1-11/2 years after tooth eruption while in the permanent this is competed by 21/2 - 3 years after eruption.
Normal eruption time - 2

• Certain factors affect the rate of eruption namely: nutritional status of the child, gender and genetic factors.

• Eruption tends to be earlier in the mandible in comparison to the maxilla.
Eruption of the deciduous teeth

• Four active phases of eruption are identified. The first phase comprised of the central and lateral incisors which erupted within 5.5 months.
• An interval of about 3.2 months in the mandible and 3.6 months in the maxilla followed before the eruption of the first molars which constitute the second active phase. All four molars are out in the oral cavity within a period of less than one month (at the average age of 16.9 months).
Eruption of the deciduous teeth - 2

- The third phase commenced with the eruption of the canines after a resting period of 3.0 months in the mandible and 2.5 months in the maxilla.
- The last phase is the eruption of the second molar that occurred after a rest period of 3.9 months in the mandible and 4.4 months in the maxilla.
Normal features of the deciduous dentition

1. The primary dentition erupts upright unlike the permanent dentition where the teeth are proclined to as to assume a wider perimeter to accommodate the larger size.

2. By 4 years, spacing between the teeth start to occur so as to accommodate the large size of the permanent dentition.
Normal features of the deciduous dentition - 2

3. The normal overjet is about 1-2mm while that of the permanent is about 2-3mm.

4. By 4 years of age, due to wearing down of the incisal edge, an edge to edge incisal relationship may occur. This is acceptable as a normal relationship in the primary dentition while this is classified as a class II in the permanent dentition.
Normal features of the deciduous dentition - 3

5. The anthropoid space is also present in the primary dentition. This is distal to the upper canine and mesial to the lower canine.
Normal features of the primary dentition - 4

6. There is also the Leeway space also called the E space. This is the difference between the combined mesiodistal width of the D and E and the combined mesiodistal width of the 4 and 5. The 4 is the exact size of the D while the 5 is smaller than the E and so in effect the leeway space is actually the E space. This Leeway space is greater in the maxilla than in the mandible.
Normal features of the deciduous dentition - 5

7. In the deciduous dentition, the molars occlude with a terminal flush. This is normal. As a variation, there could be a mesial or distal step. However, in the permanent dentition, the normal is a class I molar relationship. The 6 moves into the Leeway space to effect the observed change in the first molar relationship. This movement is greater in the maxilla than in the mandible thereby creating the observed Class I molar relationship.
Features of deciduous tooth eruption

- There is no noted sexual difference in the eruption timing – some evidence points to earlier eruption of the incisors in males and earlier completion of dentition in females.
- Eruption sequence is ABDCE.
Features of deciduous tooth eruption - 2

• The number of teeth erupted is associated with birth weight and current height of the child: there is a positive correlation between number of teeth, weight and current height of the child.
• There is a familiar trend towards early and late eruption.
• Malnutrition is associated with severe retardation of eruption.
Eruption of the permanent teeth

- Tooth eruption begins with the completion of the crown and the beginning of root formation.
- There are variation in the eruption time of the these teeth. The canine has the highest variation time followed by the 2nd premolar and the 3rd molar. The first molar has the least variation time.
Eruption of the permanent teeth - 2

- The toothless period is 0-6 days after exfoliation of the primary molars.
- In the mandible, it is 2 weeks for the central incisor; 6 weeks for the lateral incisors and canine.
- In the maxilla, it is 6 weeks for the central incisors, and 4 months for the lateral incisors and canines. This may be 1 year when there is crowding.
Eruption of the permanent teeth - 3

- Variation of timing of tooth eruption is more in the permanent dentition. This is lowest for the incisors and 1st molars (+ 0.5 years) and highest for the canines, premolars and 2nd molars (+ 1.5 years).
- Eruption of the permanent dentition appears to be ahead in girls. This sexual variation is more prominent with the canine.
- At the time of tooth eruption, a fourth of the root is usually formed.
Causes of delayed eruption

- This can happen in both the primary and permanent dentition.
- A tooth is defined to have delayed eruption when the concurrent tooth in the adjacent quadrant has erupted or when there is a delay of over 6 months after the defined normal eruption time.
- The causes could be local or systemic.
Local causes of delayed eruption

- Ankylosis of the primary teeth
- Retained deciduous teeth
- Presence of odontome
- Presence of supernumerary teeth
- Malformed teeth
- Root/crown dilaceration
- Early loss of primary teeth
- Missing tooth bud
- Malpositioning of the tooth bud
- Focal epithelial hyperplasia: gingiva scarification
- Tooth impaction
Systemic causes

- Hereditary eg ectodermal dysplasia, chondroectodermal dysplasia, hereditary gingiva fibromatosis, cleidocranial dysostosis, garners syndrome, amelogenesis imperfecta.
- Chromosomal disorders eg Down syndrome, cri-du-chat.
- Endocrine disorders eg hypopituitarism, hypothyroidism, achondroplasia.
- Metabolic disorders eg vit D deficiency.
Post eruptive movement

- Eruption continues in the oral cavity until the erupting tooth makes contact with the opposing tooth. Post eruptive movement continues from hence.
- It is a passive process (unlike the pre eruptive and eruptive movement) that continues throughout the life time of the tooth. It results from attrition of the occlusal/incisal and proximal surfaces of the tooth which then allows for continued occlusal movement and mesial drift of the teeth.
Exfoliation of the deciduous tooth

• The primary tooth all have successors and thus their lifespan is limited. Their exfoliation is as a result of pressure resorption of the root by the succedaneous tooth.

• Pre resorption, there is an initial reduction in the thickness of the bony crypts resulting in the tooth follicle having closer proximity to the root surface of the primary tooth.
Exfoliation of the deciduous tooth - 2

- Resorption proceeds crownwards and is effected by the osteoclasts which are found on the concavity of the root surface (Howship’s lacunae).
- In the incisors, resorption starts from the lingual aspect of the root surface because of the initial position of the tooth bud. The tooth bud then gets position apical to the root. Subsequently, resorption affects the entire cross section of the root in the occlusal direction.
Exfoliation of the deciduous tooth - 3

- For the molars, the tooth bud are position apical to the root surface. Root resorption starts from here.
- Root resorption continues until the tooth exfoliates.
- In some cases however, root resorption occur at an uneven rate resulting in retention of the primary tooth.
- The vitality of the pulp tissue remains unaffected during root resorption.
Exfoliation of the deciduous tooth - 4

- Root resorption also takes place in phases – the active and quiescent phase. In the active phase, root resorption takes place. In the quiescent phase, there is some repair of the resorbed area with deposition of cementum.

- In some cases, there is excessive deposition of cementum resulting in ankylosis. The ankylosed tooth appears submerged due to continued alveolar bone growth.
Disorders of exfoliation

• Exfoliation is dependent on root resorption. However, the masticatory forces play a secondary role in determining the rate of resorption. Resorption rate is faster where the masticatory force is higher.

• Exfoliation may be delayed leading to over retention of the deciduous tooth, or may be prematurely.
Premature tooth loss

Local causes
- Trauma with root fracture, Ellis class III #
- Infection eg caries
Generalised causes of tooth loss

- **Metabolic and nutritional disorders**: Avitaminosis D, scurvy, Gaucher’s disease, Takahara’s disease, hypophosphatasia, hypophostatemia.

- **Immunological disorders**: juvenile periodontitis, Down syndrome, cyclic neutropenia, Chediack Higashi syndrome.

- **Dental anomalies**: radicular dentine dysplasia, odontodysplasia.
Generalised causes of tooth loss - 2

- Papillon le fevre syndrome
- Familiar fibrous dysplasia
- Malignancies eg Burkitt lymphoma, leukaemia
- Endocrine disorder: juvenile diabetes mellitus, hyperparathyroidism, hyperthyroidism, hyperpituitarism
- Toxicity: acrodynia
Causes of over retention

• Presence of supernumerary teeth
• Ankylosis
• Following pulp therapy (pulpotomy, pulpectomy)
• Defective osteoclastic activities resulting in poor root resorption
Quizzes

• There are three quiz questions.
• Answers are highlighted in red.
Quiz 1

Eruption of the permanent dentition:

• The toothless period is 0-6 days after exfoliation of the primary molars
• The toothless period is 2 weeks for the maxillary central incisor
• The toothless period is 6 weeks for the maxillary lateral incisors and canine
• In the maxilla the toothless period for the lateral incisors may be 1 year when there is crowding
• Variation in the age of eruption of the premolar, molar and canine can be up to 1.5 years
Quiz 2

• The deciduous dentition:
• The normal molar relationship is class I
• The normal overjet is 1-2mm
• At age 4yrs, an edge to edge bite is normal
• At age 4yrs the molars lose their contacts to create space for the permanent successors
• An anterior open bite will correct itself as the permanent dentition erupts
Quiz 3

The Leeway space:

• There is the Leeway space also called the E space
• The mesiodistal width of the 4 is the exact size of the E
• The mesiodistal width of the 5 is smaller than the E
• This Leeway space is greater in the maxilla than in the mandible
• The Leeway space is a space visible in the deciduous dentition
Acknowledgement

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