1

Disorders of Tooth Development and Eruption

CHAPTER MENU

1.1 Anodontia, Hypodontia and Oligodontia

1.1.1 Definition/Description

- Anodontia: All teeth are developmentally (congenitally) missing
- Hypodontia: one to six developmentally (congenitally) missing teeth except the third molars
- Oligodontia: more than six developmentally (congenitally) missing teeth

1.1.2 Frequency

- Anodontia: extremely rare
- Hypodontia: incidence: 4.4–13.4%. The most common developmental anomaly
- Oligodontia: incidence: 0.25%
- Hypodontia of the deciduous teeth affects less than 1% of children

Handbook of Oral Pathology and Oral Medicine, First Edition. S. R. Prabhu.

Companion website: www.wiley.com/go/prabhu/oral_pathology

Figure 1.1 Hypodontia: clinical photograph of missing maxillary lateral incisors (*source:* Bin im Garten, https://commons.wikimedia.org/wiki/File:Hypodontie_der_zweiten_oberen_Schneidz%C3%A4hne_IMG_1726.JPG. Licensed under CC BY-SA 3.0).

1.1.3 Aetiology/Risk Factors

- Anodontia: mutations in *EDA*, *EDAR* and *EDARADD* genes
- Hypodontia: mutations in *MSX1*, *PAX9*, *IRF6*, *GREM2*, *AXIN2*, *LRP6*, *SMOC2*, *LTBP3*, *PITX2* and *WNT10B*. *WNT10A* genes
- Oligodontia: mutations in *MSX1*, *PAX9*, *IRF6*, *GREM2*, *AXIN2*, *LRP6*, *SMOC2*, *LTBP3*, *PITX2* and *WNT10B*. *WNT10A* genes
- Environmental factors: hypodontia can result from trauma to the developing dental tissues such as chemotherapy or radiotherapy

1.1.4 Clinical Features

- The most common missing multiple teeth (other than third molars) are:
  - Maxillary lateral incisors (Figure 1.1). This is followed by the mandibular second premolars and maxillary second premolars
  - Skin/nails/hair/sweat glands may be affected in some cases of hypodontia
  - Morphology of teeth may be defective (microdontia/peg-shaped laterals) in hypodontia
  - In Down syndrome oligodontia is common
  - Hypodontia/oligodontia might also be associated with cleft lip and palate
  - Over retention of the overlying deciduous tooth (because of the missing permanent tooth germ) occurs frequently

1.1.5 Radiographical Features

- In many cases routine radiography may reveal developmentally missing teeth

1.1.6 Diagnosis

- History
- Clinical examination
- Radiography

1.1.7 Management

- Prosthodontic treatment/implants or orthodontic treatment for edentulous spaces

1.2 Hyperdontia (Supernumerary Teeth)

1.2.1 Definition/Description

- Hyperdontia/supernumerary teeth: excess number of teeth beyond the expected 20 deciduous and 32 permanent teeth
- The shape of the supernumerary tooth may resemble a tooth of the normal series. In this case, the extra tooth is called supplemental tooth

1.2.2 Frequency

- 98% of supernumerary teeth occur in the maxilla
- In 1% of the population, a supernumerary tooth occurs in the midline in anterior maxilla; this is called mesiodens

1.2.3 Aetiology/Risk Factors

- Budding of the dental lamina: stimulus for budding is not known

1.2.4 Clinical Features

- Asymptomatic: supernumerary teeth may be detected incidentally on radiography for other reasons
- Supernumerary teeth are five times more common in the permanent dentition than in the deciduous dentition
- Supernumerary teeth may be single or multiple, unilateral or bilateral, and may be present in one or both jaws.
- The most common single supernumerary tooth: midline of the anterior maxilla, known as a mesiodens. This is also an example of microdontia
- Other supernumerary teeth: maxillary fourth molars, maxillary lateral incisors, mandibular fourth molars and mandibular premolars
- The most common site for multiple supernumerary teeth is the mandibular premolar region (Figure 1.2)

Figure 1.2 Supernumerary premolars located lingual to the mandibular first and second premolars.

- A supernumerary tooth lingual or buccal to a molar is called a paramolar
- A supernumerary tooth located distal to a third molar is called a distomolar
- Supernumerary teeth are common in patients with cleidocranial dysplasia and Gardner syndrome
- Complications of supernumerary teeth may include:
  - Delayed or ectopic eruption of adjacent teeth
  - Root resorption of adjacent teeth
  - Crowding
  - Malocclusion
  - Diastema
  - Pericoronal cyst or infection

1.2.5 Radiographical Features

- Cone beam computed tomography (CBCT) precisely defines the location of the tooth and its proximity to vital anatomical structures such as the nasal floor and nasopalatine canal

1.2.6 Diagnosis

- History
- Clinical examination
- Radiography

1.2.7 Management

- Extraction in most cases

1.3 Microdontia and Macrodontia

1.3.1 Definition/Description

- Microdontia: size of the tooth unusually smaller than average
- Macrodontia: size of the tooth unusually larger than average

1.3.2 Frequency

- Differences in prevalence rates exist
- Approximate prevalence in general population:
  - 1.58% for microdontia
  - 0.03% for macrodontia
  - Microdontia in maxillary lateral incisors ('peg laterals') is common (0.8–8.4%)

1.3.3 Aetiology/Risk Factors

- Maternal influences, genetic and environmental factors.
- Deciduous teeth are affected more due to intrauterine maternal influences
- Permanent teeth are affected more due to environmental factors

Figure 1.3 Microdontia: maxillary left lateral incisor ('peg lateral') is cone shaped and smaller than average for lateral incisor (*source:* by kind permission of Professor Charles Dunlap, Kansas City, USA).

1.3.4 Clinical Features

- Generalized microdontia involving all teeth is extremely rare
- Generalized macrodontia is rare: often seen in pituitary gigantism
- Generalized microdontia may be a feature of Down syndrome and pituitary dwarfism
- Microdontia may be associated with hypodontia
- Macrodontia may be associated with hyperdontia
- Microdontia is more frequent in females
- Macrodontia is more frequent in males
- Maxillary lateral incisor is commonly involved in microdontia (peg lateral; Figure 1.3)
- Isolated microdontia is frequently seen in third molars
- Isolated macrodontia is occasionally seen in incisors, canines, second premolars and third molars (fused and geminated teeth to be differentiated from macrodontia)

1.3.5 Diagnosis

- History
- Clinical examination
- For macrodontia, radiography is useful to rule out gemination or fusion

1.3.6 Management

- No treatment is required unless for aesthetic purposes.
- Porcelain crown for peg lateral is often used

1.4 Gemination, Fusion and Concrescence

1.4.1 Definition/Description

- Gemination: attempt at a single tooth bud to divide, resulting in a tooth with bifid crown and a common root and root canal (clinically seen as double teeth)
- Fusion: union of two normally separated tooth buds resulting in a joined tooth with confluent dentine (clinically seen as double teeth) and separate root canals
- Concrescence: union of two teeth by cementum without confluence of dentine

1.4.2 Frequency

- Varies; approximate prevalence rates are:
  - Gemination: 0.22%
  - Fusion: 0.19%
  - Concrescence: 0.8% in permanent teeth and 0.2–3.7% in deciduous teeth

1.4.3 Aetiology/Risk Factors

- Gemination and fusion: evolution, trauma, heredity and environmental factors
- Concrescence: inflammation around roots

1.4.4 Clinical Features

- Tooth count:
  - Individuals with gemination have a normal tooth count. Clinically seen as double teeth but radiograph shows common root canal (Figure 1.4a,b)
  - Individuals with fusion show a missing tooth due to the union of two teeth. Clinically seen as a large tooth crown (Figure 1.4c)
  - Individuals with concrescence have a normal tooth count. Roots of two teeth are joined by cementum (Figure 1.4d)
- Gemination: more common in the maxilla
- Fusion: more common in the mandible
- Concrescence: common in posterior maxillary region. Often, second molar roots are joined with adjacent impacted third molar roots
- Gemination and fusion in deciduous teeth may cause crowding, abnormal spacing or delayed eruption of permanent teeth

1.4.5 Radiographical Features

- Gemination: common root, common root canal
- Fusion: separate roots and root canals
- Concrescence: roots joined at cementum of two adjoining teeth. CBCT is useful for concrescence (gives a three-dimensional image)

1.4.6 Diagnosis

- History
- Clinical examination
- Radiography

1.4.7 Management

- Depends on patient requirement
- Usually not indicated unless symptomatic due to other causes, such as extensive caries, periodontal pathology or interference with tooth eruption

Figure 1.4 (a) Gemination; mandibular right incisors show gemination. Note the presence of all incisors. (b) Radiograph of bilateral gemination in maxillary central incisors. Note incisal notch and common root and root canal. (c) Fusion; shows left maxillary lateral incisor fused with the central incisor. (d) Concrescence; roots of two teeth are joined by cementum. (*sources:* a–c, by kind permission of Professor Charles Dunlap, Kansas City, USA); d, by kind permission of Dental Press Publishing, Brazil.)

1.5 Taurodontism and Dilaceration

1.5.1 Definition/Description

- Taurodontism refers to an enlarged pulp chamber, apical displacement of the pulpal floor and no constriction at the level of the cementoenamel junction
- Dilaceration refers to abnormal angulation or bend in the root

1.5.2 Frequency

- Range:
  - Taurodontism: 0.5–4.6% in general population
  - Dilaceration: 0.3–15% in general population

1.5.3 Aetiology/Risk Factors

- Taurodontism:
  - Failure of Hertwig's epithelial root sheath diaphragm to invaginate at the proper horizontal level
  - No genetic association
- Dilaceration:
  - Idiopathic
  - Injury that displaces the calcified portion of the tooth germ from the uncalcified portion resulting in an abnormal angle of the root

1.5.4 Clinical Features

- Taurodontism:
  - May be unilateral or bilateral
  - Permanent teeth are frequently affected
  - No gender predilection
  - May occur as a part of syndromes such as Klinefelter syndrome, Mohr syndrome and McCune–Albright syndrome
  - Increased frequency in patients with cleft lip, cleft palate and those with hypodontia.
  - Increased chances of pulp exposure in decayed teeth with taurodontism
  - Degree of taurodontism:
    - hypotaurodontism (mild form)
    - mesotaurodontism (moderate form)
    - hypertaurodontism (severe form)
- Dilaceration:
  - Mandibular third molars are frequently involved followed by maxillary second premolars and mandibular second molars
  - Rare in deciduous dentition
  - Asymptomatic in most cases
  - Associated with syndromes (e.g. Ehlers–Danlos syndrome)

1.5.5 Radiographical Features

- Taurodontism:
  - Commonly detected on routine radiography
  - Involved teeth presume a rectangular shape
  - The pulp chamber is exceedingly large with a greater apical–occlusal height than normal
  - The tooth lacks the usual constriction at the cervical region
  - Roots are exceedingly short and trifurcation or bifurcation may be seen a few millimetres above the apices of the roots (Figure 1.5a)
- Dilaceration:
  - Radiographically, detected as mesial or distal bend in the root (Figure 1.5b)
  - Periodontal ligament space is normal
  - Detected on routine radiography

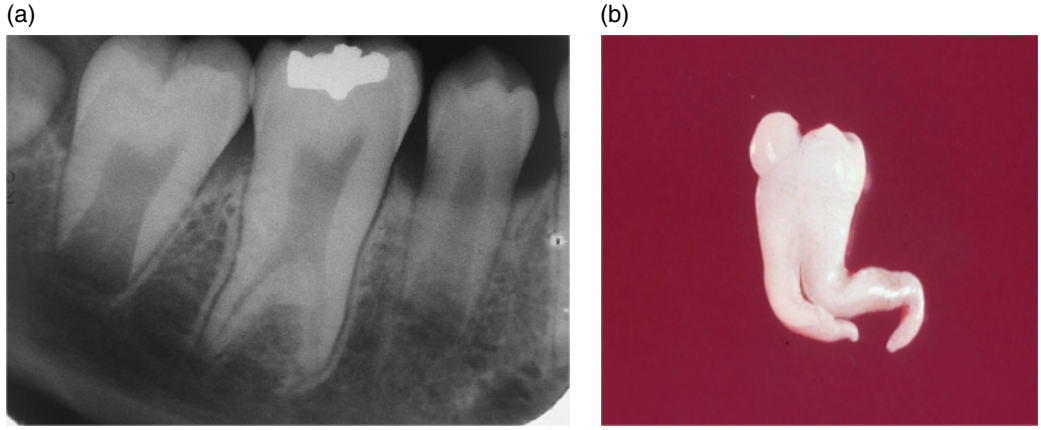

Figure 1.5 (a)Taurodontism of the mandibular first molar shows abnormally large pulp chamber and short roots. (b) Dilaceration of an extracted tooth shows abnormal bend in the roots. (*source:* by kind permission of Professor Charles Dunlap, Kansas City, USA.)

1.5.6 Management

- Taurodontism:
  - No specific treatment required
- Dilaceration:
  - No treatment for mild dilaceration
  - If symptomatic due to gross dilaceration, tooth requires surgical extraction

1.6 Amelogenesis Imperfecta

1.6.1 Definition/Description

- A group of inherited disorders caused by defects in the genes that encode enamel matrix proteins, resulting in defective structure of the enamel involving both dentitions

1.6.2 Incidence/Prevalence

- Global prevalence: 0.5%

1.6.3 Aetiology/Risk Factors

- Caused by mutations or altered expression in five genes:
  - *AMEL* (amelogenin)
  - *ENAM* (enamelin)
  - *MMP20* (matrix metalloproteinase-20)
  - *KLK4* (kallikrein-4)
  - *FAM83H*. 6–16
- Inheritance can be autosomal dominant, recessive or x-linked

1.6.4 Clinical/Radiographical Features

- Three types of amelogenesis imperfecta have been identified – hypoplastic, hypocalcified and hypomaturation:
  - Hypoplastic type:
    - Enamel is of reduced thickness due to a defect in the formation of normal matrix
    - Enamel is pitted, grooved, stained and thin
    - Enamel is normally mineralized; hard and translucent
    - Radiographically, the enamel contrasts normally from dentine
  - Hypocalcified type:
    - Enamel matrix is normal in quantity
    - Enamel calcification is defective
    - Enamel is weak in structure and vulnerable to attrition
    - Teeth become opaque, stained and rapidly wear down (Figure 1.6)
    - Radiographically, enamel is less radio-opaque than dentine
  - Hypomaturation type:
    - Enamel is normal in thickness, shows opaque brownish-yellow patches
    - Enamel mimics fluorotic mottled enamel in appearance
    - Enamel is soft and vulnerable to attrition
- Other features that may occur in any of the above types of amelogenesis imperfecta include:
  - Delay in dental eruption
  - Microdontia
  - Deviant crown and morphology
  - Root resorption
  - Short roots
  - Enlarged pulp chamber
  - Pulp stones
  - Dens in dente (dens invaginatus)
  - Tooth agenesis
  - Crowding of teeth

Figure 1.6 Amelogenesis imperfecta (hypocalcified type); the enamel is stained and vulnerable to attrition (*source:* by kind permission of Professor Charles Dunlap, Kansas City, USA).

1.6.5 Differential diagnosis

- Dental fluorosis
- Dentinogenesis imperfecta
- Enamel hypoplasia
- Trauma
- Molar incisor hypomineralization

1.6.6 Diagnosis

- History including a detailed family history
- Pedigree plotting (family health history tree)
- Clinical examination
- Radiography

1.6.7 Management

- Aesthetic treatment
- Treatment for symptoms if present (e.g. tooth sensitivity)

1.7 Dentinogenesis Imperfecta

1.7.1 Definition/Description

- A group of autosomal dominant genetic conditions characterized by abnormal dentin structure affecting both the primary and secondary dentitions

1.7.2 Frequency

- Incidence of 1 in 6000 to 1 in 8000

1.7.3 Aetiology/Risk Factors

- Mutations in dentin sialoprotein genes

1.7.4 Clinical Features

- Primary and permanent teeth are affected
- Teeth appear amber, brown/blue, or opalescent brown (Figure 1.7a)
- Syndromic form, osteogenesis imperfecta: opalescent dentine, blue sclera and short stature

1.7.5 Radiographical features

- The crowns may appear bulbous (Figure 1.7b)
- Pulp chambers are often small or obliterated
- The roots are often narrow with small or with obliterated root canals

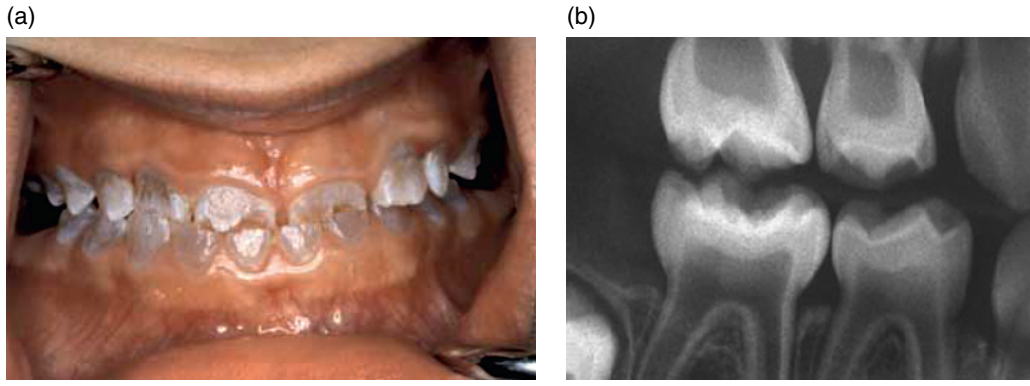

Figure 1.7 Dentinogenesis imperfecta. (a) Note tooth wear and opalescent crowns. (b) Radiograph shows bulbous crowns and cervical constriction of molars. (*source:* by kind permission of Professor Charles Dunlap, Kansas City, USA.)

1.7.6 Differential Diagnosis

- Hypocalcified forms of amelogenesis imperfecta
- Osteogenesis imperfecta
- Congenital erythropoietic porphyria
- Conditions leading to early tooth loss
- Permanent teeth discolouration due to tetracyclines
- Vitamin D-dependent and vitamin D-resistant rickets

1.7.7 Diagnosis

- Family history
- Pedigree construction
- Detailed clinical examination
- Radiography

1.7.8 Management

- The aims of treatment are to remove sources of infection or pain, restore aesthetics and protect posterior teeth from wear
- Preservation of occlusal face height, maintenance of function and aesthetic needs are priorities
- For the primary dentition, stainless steel crowns are recommended

1.8 Dentinal Dysplasia (Dentin Dysplasia)

1.8.1 Definition/Description

- A rare inherited disorder of dentin formation characterized by either absent or short conical roots
- Two types occur: radicular dentin dysplasia (type 1) and coronal dentin dysplasia (type 2)
- Coronal dentin dysplasia is a severe form of dentinogenesis imperfecta

1.8.2 Frequency

- Type 1: 1 in 100 000
- Type 2: 1 in 6000 to 1 in 8000

1.8.3 Aetiology/Risk Factors

- Defective dentin sialoprotein gene for both types

1.8.4 Clinical Features

- Radicular type (type 1):
  - Diffusely affects both dentitions: severe manifestations in deciduous teeth
  - Coronal enamel and dentin are normal
  - Radicular dentin is defective: short roots result in tooth mobility and premature tooth loss
  - Strength of roots is reduced
  - Hypersensitive dentin
  - Loss of pulpal vitality
  - Absent root canals
  - Bifurcation is close to the apex in molars
  - Periapical pathology is common (seen as periapical radiolucency)
- Coronal type (type 2):
  - Primary and permanent teeth are affected
  - Teeth appear amber, brown/blue or opalescent brown

1.8.5 Radiographical features

- Coronal type:
  - The crowns may appear bulbous
  - Pulp chambers are often small or obliterated
  - The roots are often narrow with small or obliterated root canals
  - Roots may be absent (Figure 1.8)

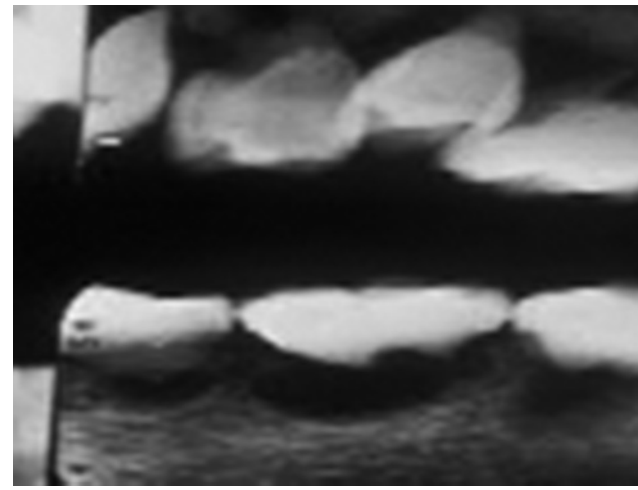

Figure 1.8 Dentinal dysplasia radiograph showing absence of roots (*source:* by kind permission of Professor Charles Dunlap, Kansas City, USA).

1.8.6 Differential Diagnosis

- Dentinogenesis imperfecta
- Osteogenesis imperfecta
- Conditions that cause premature loss of teeth

1.8.7 Diagnosis

- Family history
- Clinical examination
- Radiography

1.8.8 Management

- Symptomatic and preventive care and meticulous oral hygiene

1.9 Regional Odontodysplasia (Ghost Teeth)

1.9.1 Definition/Description

- A rare non-hereditary dental anomaly involving enamel, dentin and cementum of both dentitions, but mostly the teeth of one quadrant

1.9.2 Frequency

- A rare disorder

1.9.3 Aetiology/Risk Factors

- Unknown
- Probably alteration in vascular supply in the jaws around developing teeth

1.9.4 Clinical Features

- Female predilection (female to male ratio 1.7 : 1)
- Both dentitions are involved
- Mostly one but rarely two quadrants are involved
- Age at diagnosis: 2–4 years for deciduous teeth and 7–11 years for permanent teeth
- Maxillary predominance (ratio of maxillary to mandibular width 1.6 : 1)
- Failure of tooth eruption is common
- Erupted teeth exhibit small brown crowns
- Pulp necrosis is common
- Early tooth exfoliation

1.9.5 Radiographical features

- Thin enamel and dentin appear surrounding enlarged radiolucent pulp chamber (hence the name ghost tooth)
- Pulp stones are occasionally detected on radiography

1.9.6 Differential Diagnosis

- Oculodentodigital dysplasia
- Segmental odontomaxillary dysplasia
- Odonto-onychodermal dysplasia
- Odontochondrodysplasia

1.9.7 Diagnosis

- History
- Clinical examination
- Radiography

1.9.8 Management

- Unerupted teeth to remain without any interference
- Erupted teeth: steel crowns
- Non-salvageable teeth to be extracted

1.10 Delayed Tooth Eruption

1.10.1 Definition/Description

- Delayed tooth eruption is the emergence of a tooth into the oral cavity at a time that deviates significantly from norms established for different races, ethnic groups and sexes

1.10.2 Frequency

- Delayed eruption is relatively common; racial and gender variations exist
- Failure of eruption is less common
- Agenesis of teeth cause failure of eruption

1.10.3 Aetiology/Risk Factors

- Local causes associated with delayed tooth eruption:
  - Supernumerary teeth
  - Mucosal barrier scar tissue due to trauma/surgery/gingival hyperplasia
  - Tumours: odontogenic or non-odontogenic tumours
  - Ankylosis of deciduous teeth
  - Enamel pearls
  - Injuries to primary teeth
  - Regional odontodysplasia
  - Ectopic eruption
  - Impacted permanent teeth
  - Embedded primary teeth
  - Oral clefts
  - Radiation damage

- Systemic causes associated with delayed tooth eruption:
  - Nutritional deficiencies
  - Vitamin D-resistant rickets
  - Hypoparathyroidism
  - Hypopituitarism
  - Long-term chemotherapy
  - Cerebral palsy
  - Prematurity or low birth weight
  - Phenytoin use
  - Genetic disorders

1.10.4 Clinical and Radiographical Features

- Local factors causing delayed tooth eruption are frequently detected by radiography
- Systemic factors causing delayed tooth eruption are detected by systemic clinical features and laboratory findings
- Failure of tooth eruption: congenital absence of teeth (third molars, mandibular second premolars and maxillary lateral incisors) results in failure of tooth eruption
- Radiographical evidence of absence of teeth is diagnostic

1.10.5 Diagnosis

- History
- Clinical examination
- Radiography (panoramic view is ideal)
- Laboratory tests if systemic factors are suspected

1.10.6 Management

- Patient with eruption delay of more than 12 months (delayed eruption) of the normal age range should be referred to a paediatric dentist for further evaluation
- Identification of the causes and their elimination is important
- Surgical exposure followed by orthodontic treatment may be required for some patients with delayed eruption

1.11 Tooth Impaction (Impacted Teeth)

1.11.1 Definition/Description

- Teeth that are completely or partially retained in the jaws beyond their normal date of eruption

1.11.2 Frequency

- Common; variations in incidence and prevalence exist
- The mandibular third molars are the most common impacted teeth, with their prevalence ranging from 27% to 68.8% in various parts of the world

- The reported prevalence of impacted teeth of canines and second premolars ranges from 2.9% to 13.7%

1.11.3 Aetiology

- Lack of space for tooth eruption due to inadequate arch length
- Crowding of teeth
- Dense overlying bone
- Excessive soft tissue in the path of eruption
- Genetic abnormalities
- Long tortuous path of eruption (for canines)

1.11.4 Clinical Features

- Frequently impacted teeth: mandibular third molars followed by the maxillary third molars, maxillary canines and mandibular premolars
- Young adults are commonly affected; often detected on routine radiography
- Impacted deciduous teeth are extremely rare
- Impacted permanent first and second molars are rare
- Often supernumerary teeth are impacted (detected on radiography)
- Impacted teeth may or may not be symptomatic
- With no history of extraction, clinically the number of teeth present in the dentition is less than normal
- Impaction can be full or partial
- Symptomatic patients with lower third molar may complain of earache or paraesthesia of the lip
- Pericoronitis may occur (pain, inability to open the mouth, swelling of the pericoronal soft tissue)
- Often, all four third molars may be impacted
- Occasionally impactions are associated with syndromes or odontogenic cysts and tumours

1.11.5 Radiographical Features

- Types of impaction: mesioangular, distoangular, vertical or horizontal impaction for third molars (Figure 1.9 a-d). Canine impaction may be bilateral (Figure 9 e) or inverted
- Proximity of the impacted tooth to the inferior dental nerve for lower third molar impactions may cause paraesthesia
- Impacted teeth may be associated with cysts or odontogenic tumours

1.11.6 Diagnosis

- History
- Clinical examination
- Radiography (panoramic view)

1.11.7 Management

- No treatment is required for asymptomatic impactions
- Surgical removal for symptomatic impacted teeth
- Surgery for impacted teeth associated with cysts or tumours

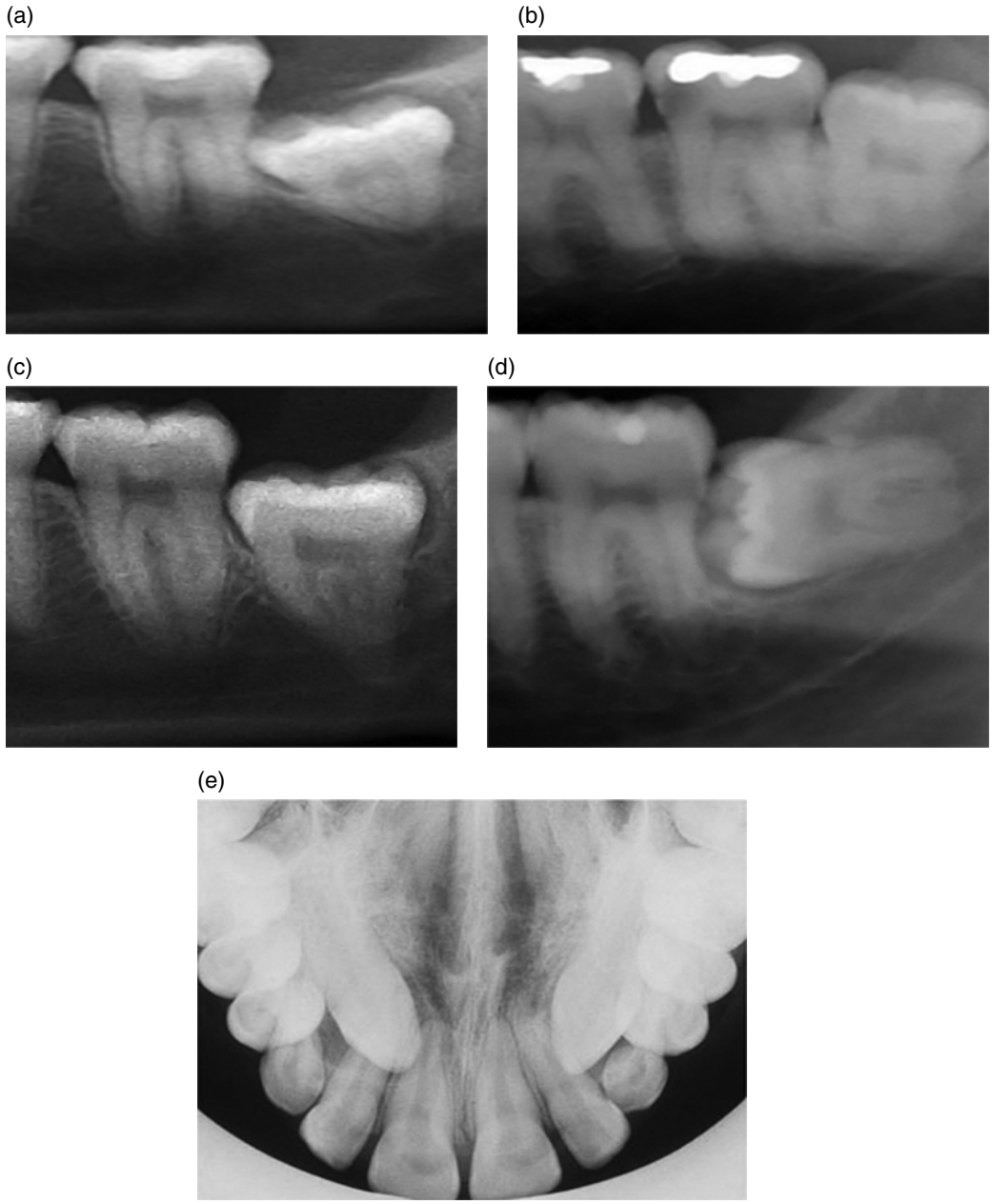

Figure 1.9 (a) Mesioangular impaction of the mandibular third molar. (b) Distoangular impaction of the mandibular third molar (c) Vertical impaction of the mandibular third molar. (d) Horizontal impaction of the mandibular third molar. (e) Bilateral impaction of maxillary canines.

1.12 Dens Invaginatus and Dens Evaginatus

1.12.1 Definition/Description

- Dens invaginatus refers to an exaggeration of the process of formation of lingual pit causing invagination (also called dens in dente or dilated odontome)

- Dens evaginatus refers to an enamel and dentin covered spur extending outward from the occlusal surfaces of molars or premolars and rarely lingual surfaces of lower anterior teeth. This is the opposite of dens evaginatus (also called evaginated odontome)

1.12.2 Frequency

- Dens invaginatus: prevalence: 0.3–10%, affecting more males than females
- Dens evaginatus: more common in people of Asian descent; prevalence: 0.06–7.7%; 15% in Inuit and Native American populations

1.12.3 Aetiology/Risk Factors

- Dens invaginatus:
  - Deepening or invagination of the enamel organ into the dental papilla prior to calcification of the dental tissues
  - Genetics may play a role
- Dens evaginatus:
  - A result of an unusual growth and folding of the inner enamel epithelium and ectomesenchymal cells of dental papilla into the stellate reticulum of the enamel organ

1.12.4 Clinical Features

- Dens invaginatus:
  - The permanent maxillary lateral incisors appear to be the most frequently affected tooth (90% of all cases)
  - Maxillary posterior teeth: 6.5% of all cases
  - Mandibular teeth are very rarely affected
- May be associated with taurodontism, microdontia, gemination, supernumerary tooth and dentinogenesis imperfecta

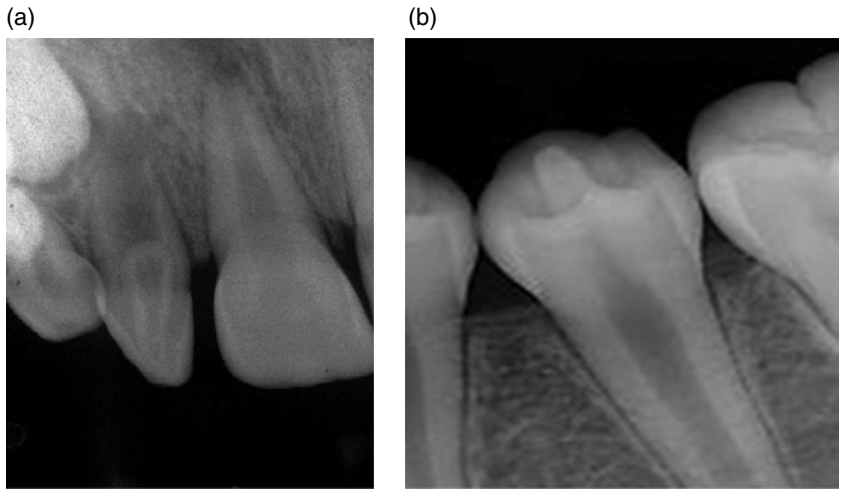

Figure 1.10 (a) Dens invaginatus; radiograph showing dens invaginatus in a peg lateral incisor (*source:* by kind permission of Professor Charles Dunlap, Kansas City, Kansas, USA). (b) Dens evaginatus; radiograph showing dens evaginatus. Note a tubercle extending outward from the occlusal surface of the premolar.

- Causes food debris deposits and renders tooth vulnerable to caries
- Dens evaginatus:
  - More common in mandibular premolar teeth
  - May be bilateral and symmetrical tubercles on the occlusal surfaces of posterior teeth or on lingual surfaces of lower anterior
  - Slight female sex predilection
  - Can cause malocclusion with opposing teeth
  - Abnormal wear and fracture of the tubercle may occur

1.12.5 Radiographical features

- Three types of dens invaginatus occur which can be detected on radiography:
  - Type I: invagination ends in a blind sac, limited to the tooth crown (Figure 1.10a)
  - Type II: invagination extends to the cementoenamel junction extending in a blind sac. It may or may not extend into the root pulp
  - Type III: invagination extends to the interior of the root providing an opening to the periodontium, sometimes this presents another foramen in the apical region of tooth
  - Dens evaginatus shows a tubercle on the occlusal surface (Figure 1.10b)

1.12.6 Diagnosis

- History
- Clinical examination (tooth morphology)
- Radiography (intraoral periapical views)

1.12.7 Management

- Dens invaginatus: placement of sealants and endodontic treatment for severe cases
- Dens evaginatus: removal of the tubercle and application of fluorides

1.13 Fluorosis (Mottled Enamel)

1.13.1 Definition/Description

- Dental fluorosis (mottled enamel) is a qualitative defect of enamel resulting from an increase in fluoride concentration during enamel formation

1.13.2 Frequency

- Fluorosis is extremely common
- Global variations exist. The global prevalence of fluorosis is reported to be about 32%

1.13.3 Aetiology/Risk Factors

- A higher than normal amount of fluoride ingestion while teeth are forming
- When the level of fluoride is above 1.5 mg/l (1.5 ppm) in drinking water, dental fluorosis occurs
- The severity of fluorosis is dependent on the dose and time of exposure to fluoride levels

- Other sources of fluoride: toothpastes, mouth rinses, fluoride supplements, beverages (brick tea, tea and butter tea) and food (infant formula, fish, beans, potatoes and wheat)

1.13.4 Clinical Features

- Severity of fluorosis is dose dependent
- Mild fluorosis: opaque lines following the perikymata
- Moderate fluorosis: the opaque lines merge and more irregular cloudy areas become visible
- Severe fluorosis: enamel is grossly defective with opaque chalky appearance and punched out pits. Extrinsic brown staining in the pits is frequent (Figure 1.11)
- Moderate to severe enamel fluorosis is called mottled enamel
- Teeth with fluorosis are weak but resistant to caries

1.13.5 Differential Diagnosis

- Turner's hypoplasia
- Hypoplastic teeth in systemic disorders
- Amelogenesis imperfecta
- Early carious lesions
- Tetracycline staining of teeth

1.13.6 Diagnosis

- History (residence/ migration, water fluoridation, other sources of fluorides in the diet)
- Clinical examination

1.13.7 Management

- Aesthetic procedures as required

Figure 1.11 Yellow-brown discoloration of maxillary incisors due to fluorosis (*source:* From Mary A. Aubertin. 2014. Common Benign Dental and Periodontal Lesions. In: *Diagnosis and Management of Oral Lesions and Conditions: A Resource Handbook for the Clinician*. ed. Cesar A. Migliorati and Fotinos S. Panagakos. IntechOpen. doi: 10.5772/57597).

- Close monitoring of sources of fluoride during the first three years of age
- Water fluoridation: 0.7–1 ppm recommended
- Use of fluoride tooth paste after 12 months of age
- Infant formula with fluoridated water to be avoided
- Fluoride supplements only in non-fluoridated areas

1.14 Tetracycline-Induced Discoloration of Teeth: Key Features

- Tetracycline is a broad-spectrum antibiotic commonly used for infections
- Tetracycline has several different analogues such as doxycycline, oxytetracycline, minocycline, chlortetracycline, demeclocycline
- Tetracycline can stain teeth if ingested by the mother in the third trimester or by the child during the years of tooth formation of deciduous and permanent dentition
- The discoloration, which is permanent, varies from yellow or grey to brown (Figure 1.12)
- Administration of tetracycline to pregnant women must be avoided during the second or third trimester of gestation and to children up to eight years of age.
- Tetracycline-stained teeth must be differentiated from dentinogenesis imperfecta

Figure 1.12 Tetracycline-induced grey/brown discolouration of deciduous teeth in a child (*source:* by kind permission of Professor Charles Dunlap, Kansas City, Kansas, USA).

1.15 Enamel Pearl: Key Features

- The enamel pearl is a globule of enamel formation located on the root surface (Figure 1.13)
- It is characterized by a core of dentin covered by enamel and may contain a pulp chamber
- Enamel pearl may cause periodontal pockets and periodontitis

Figure 1.13 Enamel pearl on the cementum (*source:* by kind permission of Professor Charles Dunlap, Kansas City, Kansas, USA).

1.16 Talon Cusp: Key Features

- Talon cusp is a rare developmental anomaly presenting as a wisp-like structure arising from the cervical region of anterior teeth
- Resembles an eagle's talon

Figure 1.14 Periapical radiograph of talon cusp on a partially erupted upper left permanent maxillary incisor in an eight-year-old boy. Note V-shaped radiopaque structure overlapping the affected crown with its apex directed incisally (*source:* Matthew Fergusson, https://en.wikipedia.org/wiki/File:Talon_cusp.png. Licensed under CC BY-SA 4.0).

- In canines and incisors, it originates usually in the palatal cingulum as a tubercle projecting from the palatal surface
- Its prevalence varies from less than 1% to approximately 8%
- Radiographically, talon cusp appears as appears as a V-shaped radiopaque structure overlapping the affected crown with its apex directed incisally (Figure 1.14)
- Symptoms include interference with occlusion, irritation of soft tissues, accidental cusp fracture and susceptible to dental caries

1.17 Hutchinson's Incisors and Mulberry Molars: Key Features

- 'Hutchinson's incisors' and 'Mulberry molars' are dental developmental defects seen in children with congenital syphilis; they are rare conditions
- In Hutchinson's incisors, the incisal edge is either notched or screwdriver shaped. The bulbous crown is short and narrow ('barrel shaped'). In the centre of the incisal edge a deep vertical central notch may be present (Figure 1.15a)
- Mulberry molars are characterized by multiple rounded rudimentary enamel cusps on the permanent first molars (Figure 1.15b)
- Hutchinson's incisors and mulberry molars are caused by direct invasion of tooth germs by Treponema organisms during tooth development

(a) (b)

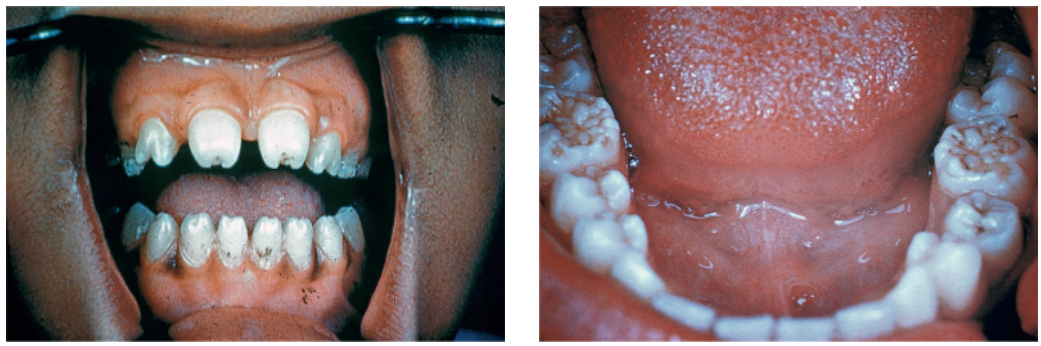

Figure 1.15 (a) Hutchinson's incisors of congenital syphilis. Note screwdriver shape and central notch on the crowns of upper and lower permanent incisors. (b) Mulberry molars of congenital syphilis. Note multiple poorly formed globular cusps on the occlusal surfaces of mandibular permanent first molars. (*source:* images by kind permission of Professor Charles Dunlap, Kansas City, Kansas, USA.)

1.18 Tooth Ankylosis: Key Features

- Anatomical fusion of tooth cementum with the alveolar bone:
  - Mandibular primary first molars are frequently ankylosed
  - Ankylosis of permanent teeth is uncommon
  - A sharp solid note on percussion is noted, suggesting ankylosis
  - Periodontal ligament space is absent on radiography
  - In many examples, the permanent successor is missing

Figure 1.16 An extracted mandibular molar with three roots.

1.19 Supernumerary Roots: Key Features

- Normally, the permanent mandibular first molar has two roots, one mesial and one distal root
- Rarely, an additional third root is seen, which is found distolingually, called the radix entomolaris (Figure 1.16)
- Occasionally, supernumerary roots may be detected in mandibular third molars, mandibular canines and premolars
- No treatment is required
- Detection is critical for endodontic treatment

Recommended Reading

Consolaro, A., Hadaya, O., Oliveira Miranda, D.A., and Colsolaro, R.B. (2020). Concrescence: can the teeth involved be moved or separated? *Dental Press Journal of Orthodontics* 25 (1): 20–25.

Miletich, I. and Sharpe, P.T. (2003). Normal and abnormal dental development. *Human Molecular Genetics* 12 (Suppl 1): R69–R73.

Neville, B.W., Damm, D.D., Allen, C.M., and Chi, C.A. (2016). Developmental alterations of teeth. In: *Oral and Maxillofacial Pathology*, 4ee, 49–92. St. Louis, MO: Elsevier.

Odell, E.W. (2017). Disorders of tooth development. In: *Cawson's Essentials of Oral Pathology and Oral Medicine*, 9ee, 23–42. Edinburgh: Elsevier.

Parsa, A. and Rapala, H. (2016). Endodontic treatment of a mandibular 6 years molar with three roots: a pedodontist perspective. *International Journal of Pedodontic Rehabilitation* 1: 64–67.

Rhoads, S.G., Hendricks, H.M., and Frazier-Bowers, S.A. (2013). Establishing the diagnostic criteria for eruption disorders based on genetic and clinical data. *American Journal of Orthodontics and Dentofacial Orthopaedics* 144 (2): 194–202.

Rosa, D.C.L., Simukawa, E.R., Capelozza, A.L.A. et al. (2019). Alveolodental ankylosis: biological bases and diagnostic criteria. *RGO Revista Gaúcha de Odontologia* 67: e2019003.

Seow, W.K. (2014). Developmental defects of enamel and dentine: challenges for basic science research and clinical management. *Australian Dental Journal* 59 (1 Suppl): 143–154.