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Dental Anomalies *Part 1*

DENT5312

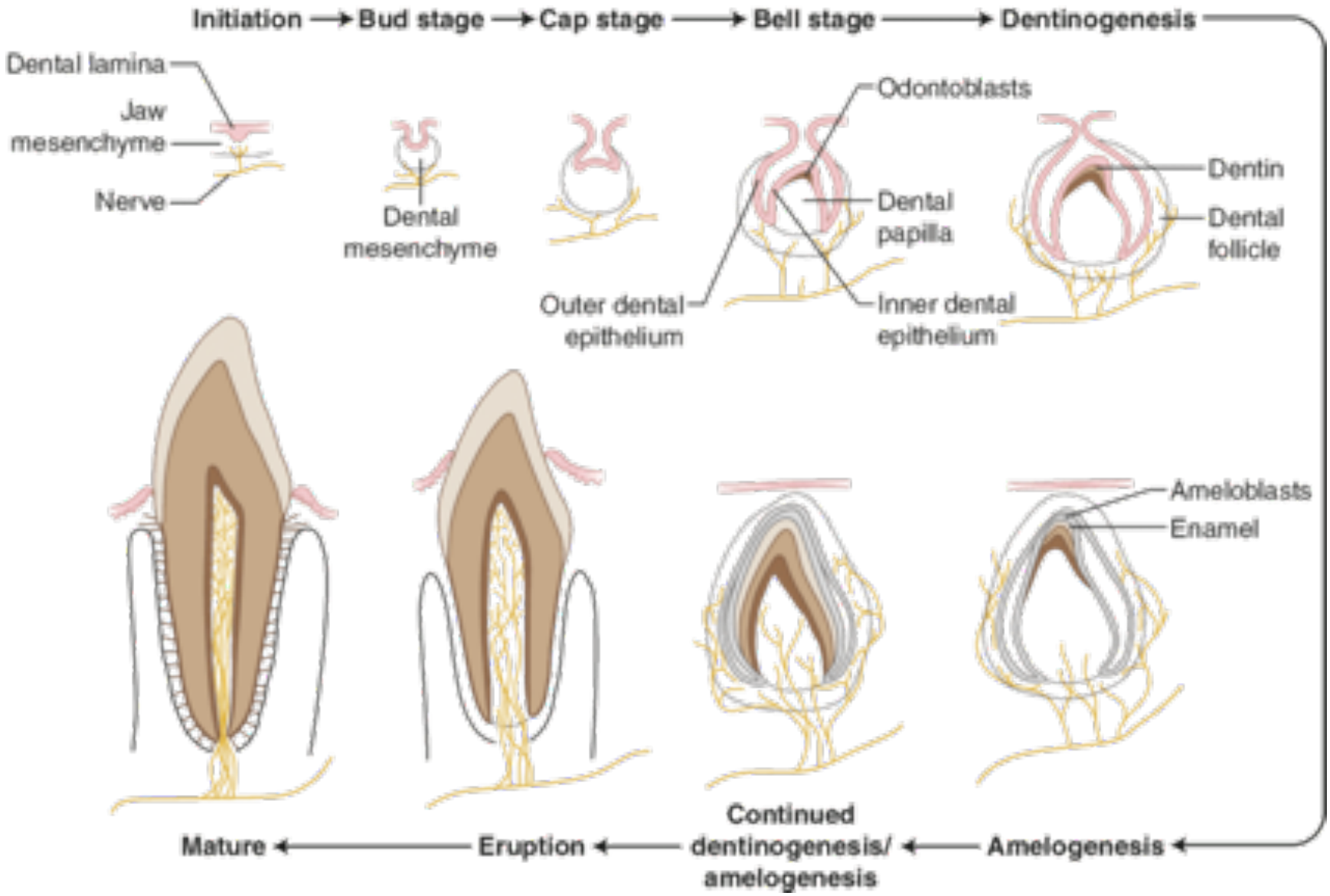
Dr Jilen Patel

Lecture Outcomes

Students should be able to:

- Understand the stages of tooth development and the associated anomalies that can occur at different stages
- Explain the difference between anomalies and traits
- Define anomalies of tooth size and shape
- Explain the aetiology, prevalence, clinical characteristics, implications and potential management strategies for anomalies of tooth size and shape
- Identify anomalies of tooth size and shape through visual and radiographic examinations

Stages of tooth development



Stages of tooth development

Stage	Process	Activity	Associated anomalies
Bud	Initiation	Migration of neural crest cells into arches	Tooth number (supernumerary teeth, hypodontia…)
Cap	Proliferation	Condensation of ectoderm and formation of dental organ and dental papilla	Odontogenic cysts
Bell	Morphodifferentiation	Proliferation of inner enamel epithelium to form the shape of the crown	Tooth size and shape (macrodontia, microdontia…)
	Histodifferentiation	Differentiation of precursor cells ameloblasts and odontoblasts	Regional odontodysplasia
Crown	Apposition	Reciprocal induction and laying down of mantle dentine and first enamel	Enamel hypoplasia
	Calcification		Amelogenesis Imperfecta Dentinogenesis Imperfecta
	Maturation	Enamel crystal formation	Enamel hypomineralisation
	Eruption	Emergence of tooth and continued development of roots	Impacted teeth

Stages of tooth development

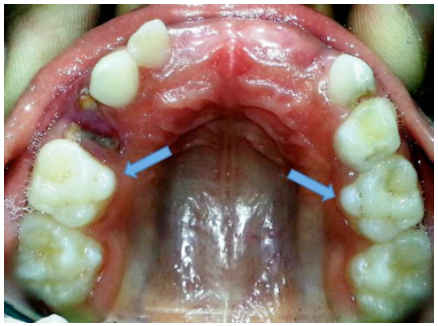
Anomaly or trait?

Anomaly: when a variant occurs *rarely* in a given population

eg anomalies in tooth number, size, shape, structure

Trait: when a variant is exhibited by a significant number of people in a population such that it is considered a trait for the dentition of that population

eg incisor shovelling, cusp of Carabelli, protostyloid



ANOMALIES OF TOOTH NUMBER

Hyperdontia

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Definition

Any tooth or structure formed from a tooth germ **that is in excess of the usual number** for any given region of the dental arch

Terminology

- Supernumerary
- Polyphodontism (Gibbs, 1913)
- Third dentition, superdentition (Gissen, 1935)
- Duplicate teeth (Werther & Rothenberg, 1939)
- Supplemental (Glassington, 1893)
- Aberrant (Nodine, 1943)
- Conoidal (Fashlicht, 1943)

Etiology

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- Remains unclear
- Various theories have been postulated:
  - Result of hyperactivity of the dental lamina (Black, 1909)
  - Tooth germ dichotomy (split of tooth germ): an imbalance between molecules can cause the tooth germ to divide into two parts, of equal or different size (Gardiner,1961)
  - Genetic predisposition
  - Environmental factors
  - Multifactorial, a combination of environmental and genetic factors (Brook, 1984)

Hyperdontia

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Prevalence

- Permanent dentition > primary dentition (Clayton, 1956)
- Primary dentition: 0.2-0.8%
- Permanent dentition: 0.5-3.5%

(Garvey et al. 1999; Sasaki et al. 2007; Ferrés-Padró et al. 2009; Kaya et al. 2011)

- Male > Females
- Male : Female = 1.18 : 1.0

(Brook, 1984; Fernandez Montenegro et al. 2006; Liu et al. 2007; Ferres-Padro et al. 2009)

- Maxillary incisor region > mandibular premolar > maxillary molar region

(Grahnen and Lindalh, 1961; King et al. 1993)

Supernumerary

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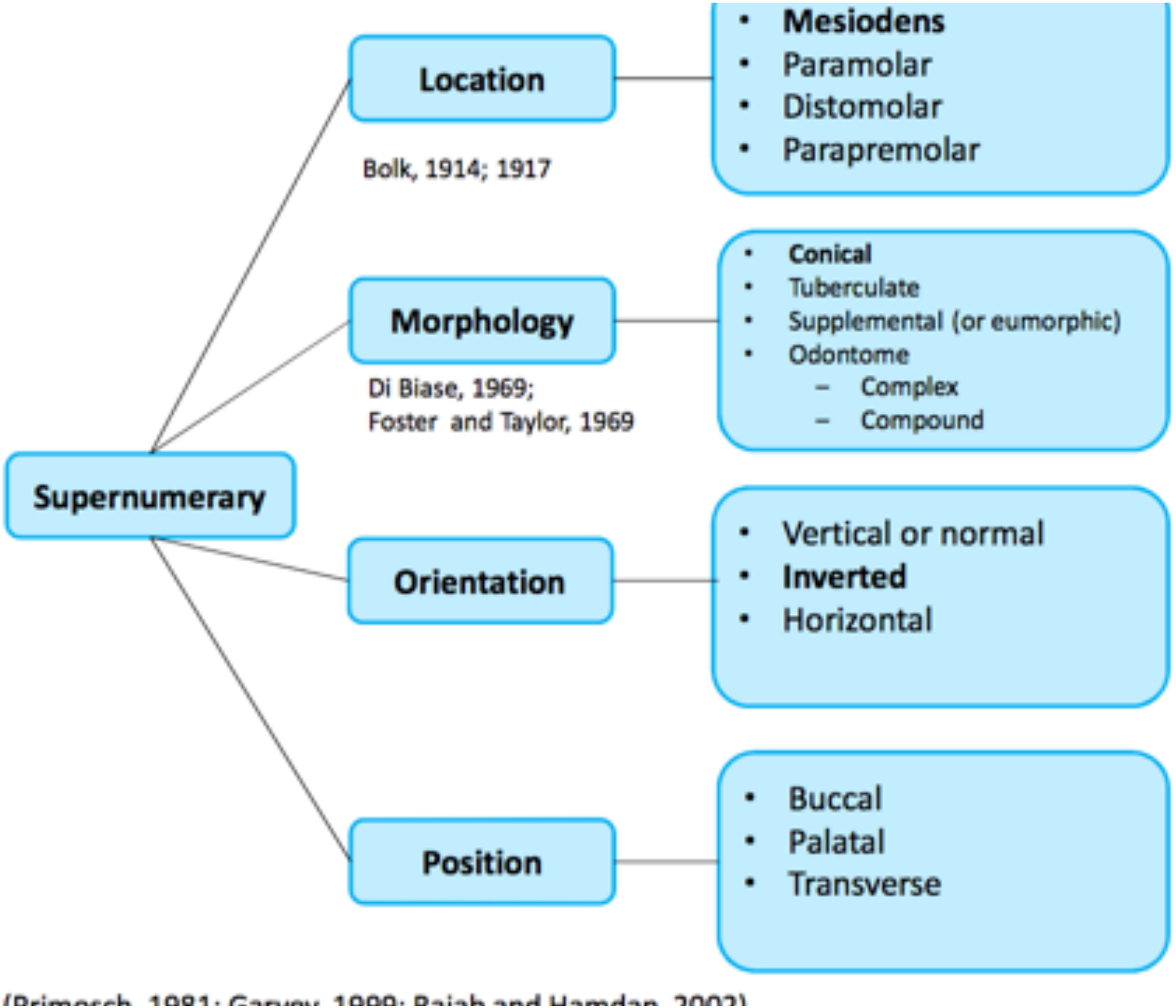
Supernumerary teeth

- Definition: any tooth or odontogenic structure that is formed from a tooth germ in excess of the usual number for any given region of the dental arch

  (Shafer, 1983)

- The term "hyperdontia" is preferred by some authors to describe the dentition which contains one or more supernumerary teeth

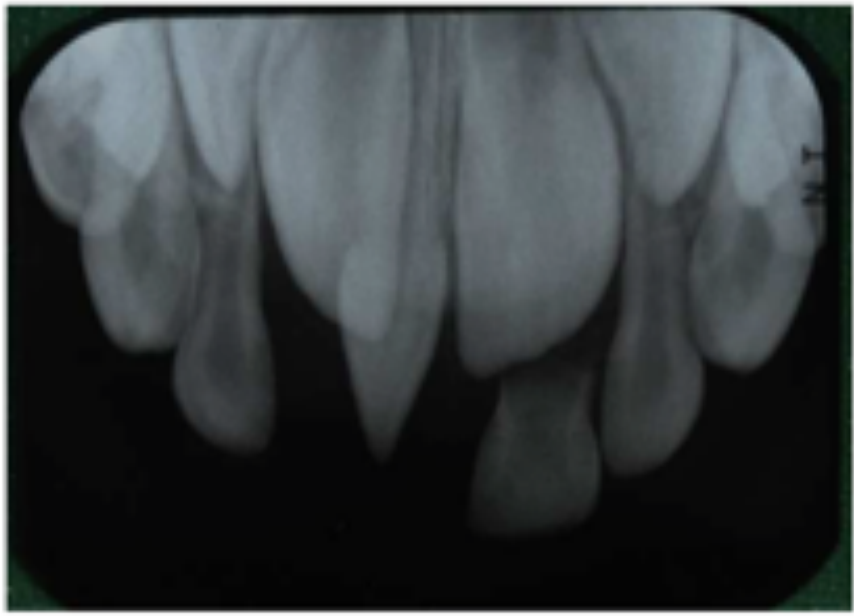
Classification of Supernumerary



(Primosch, 1981; Garvey, 1999; Rajab and Hamdan, 2002)

Mesiodens

- Mesiodens: the most “mesially invested tooth”…”the lost incisor” (Bolk,1917)
- Most common type of supernumerary



Supernumerary tooth in the primary dentition

Supernumerary

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Supernumerary tooth in the primary dentition

Supernumerary

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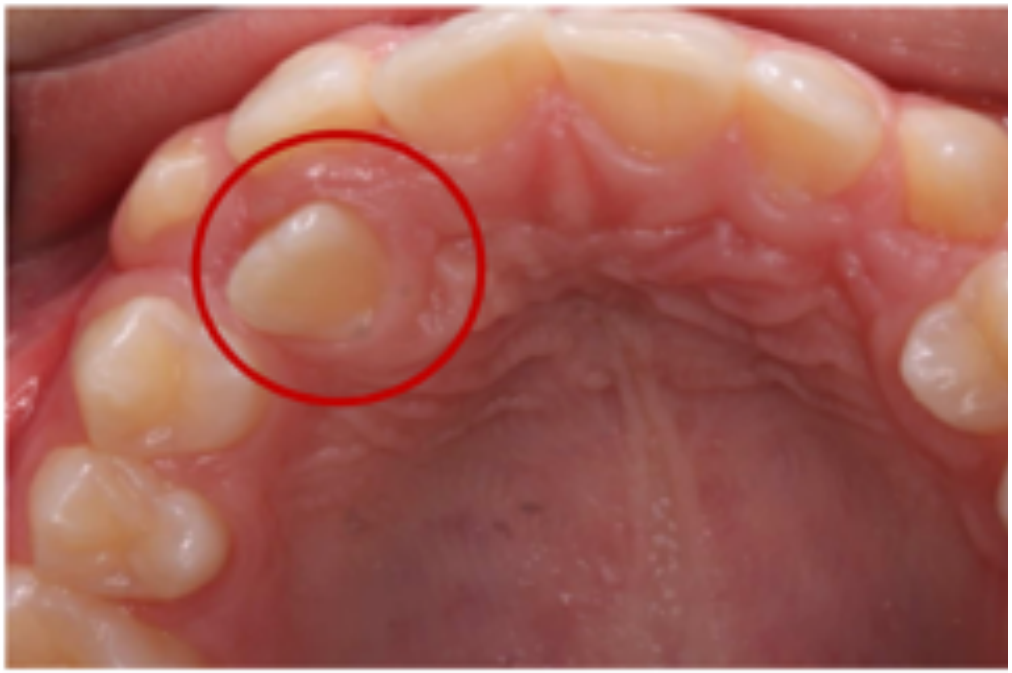
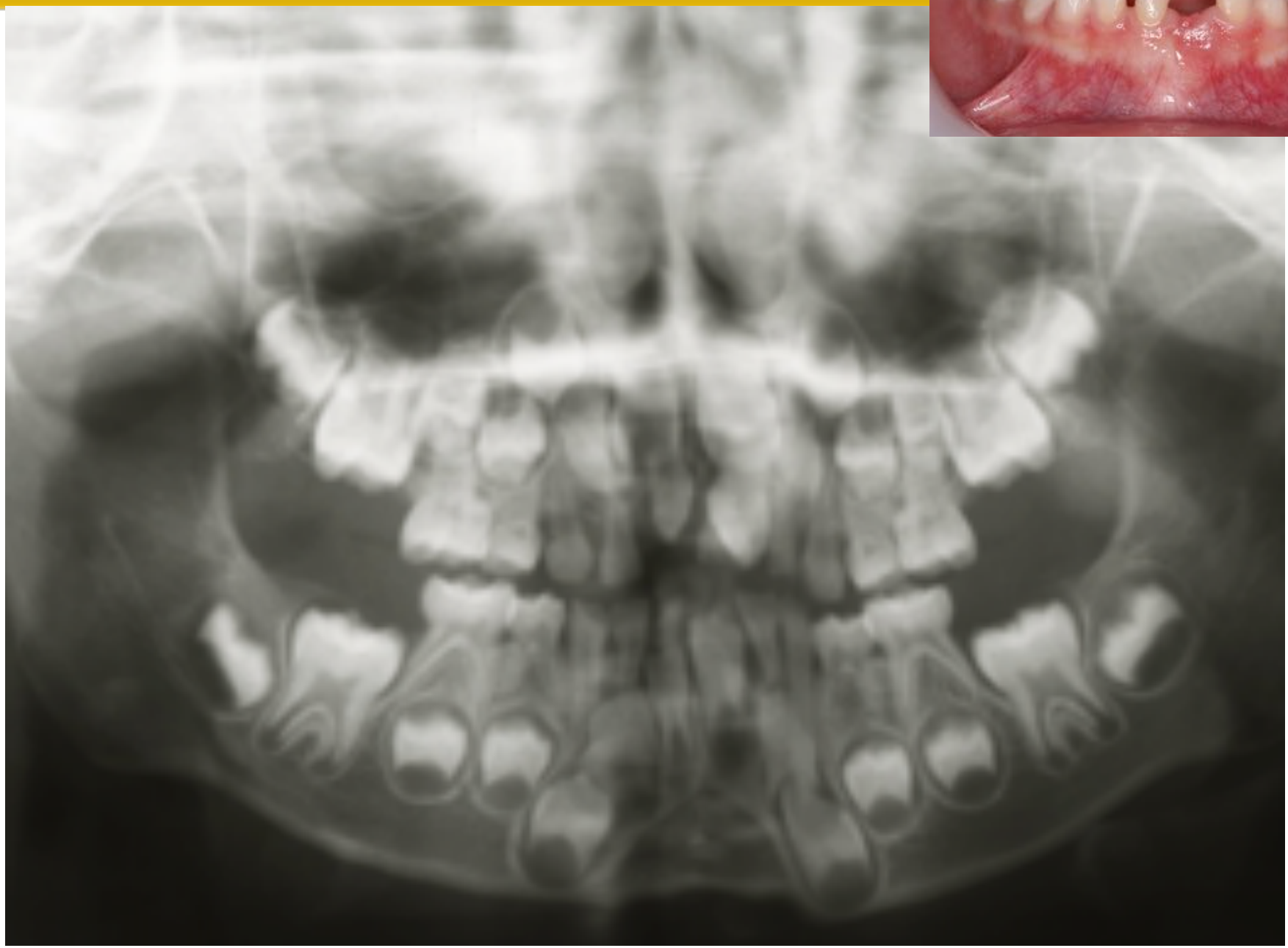
Supernumerary tooth



Supplemental lateral incisor



Hyperdontia

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- Conditions and syndromes associated with hyperdontia:
  - Cleft lip and palate
  - Cleidocranial Dysplasia
  - Gardner Syndrome (Familial Adenomatous Polyposis)
  - Nance-Horan Syndrome
  - Tricho-Rhino-Phalangeal Syndromes
  - Fabry Anderson's syndrome
  - Chondroectodermal dysplasia (Ellis–Van Creveld syndrome)
  - Ehlers– Danlos syndrome
  - Incontinentia pigmenti

Omami et al 2018

Hyperdontia

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Odontomes

- Odontomes occur because of disordered differentiation and often present because of failure of eruption of a permanent tooth

Types:

- Complex: haphazard arrangement of enamel, dentine and cementum
- Compound: consists of discrete tooth-like structures

Management

- Surgical enucleation
- May require surgical exposure and orthodontic alignment

Hyperdontia

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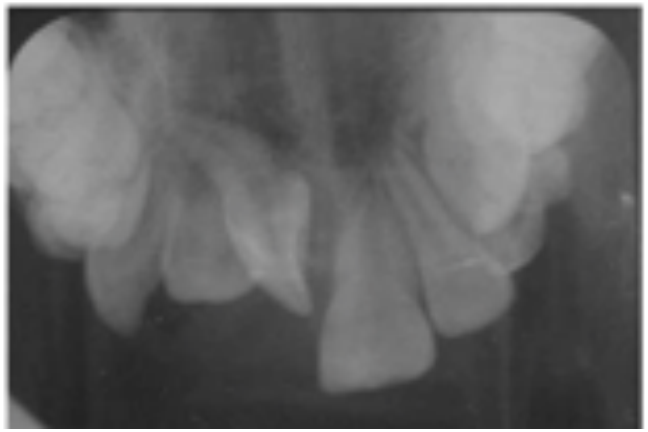
Clinical Signs

- Spacing e.g midline diastema
- Failure of adjacent teeth to erupt
  - Especially with failure of upper incisors to erupt
  - Also may cause retention of primary incisors
- Displacement
  - May cause displacement of permanent tooth from mild rotation to complete displacement
- Eruption into mouth
- Local crowding or irregularity



Hyperdontia

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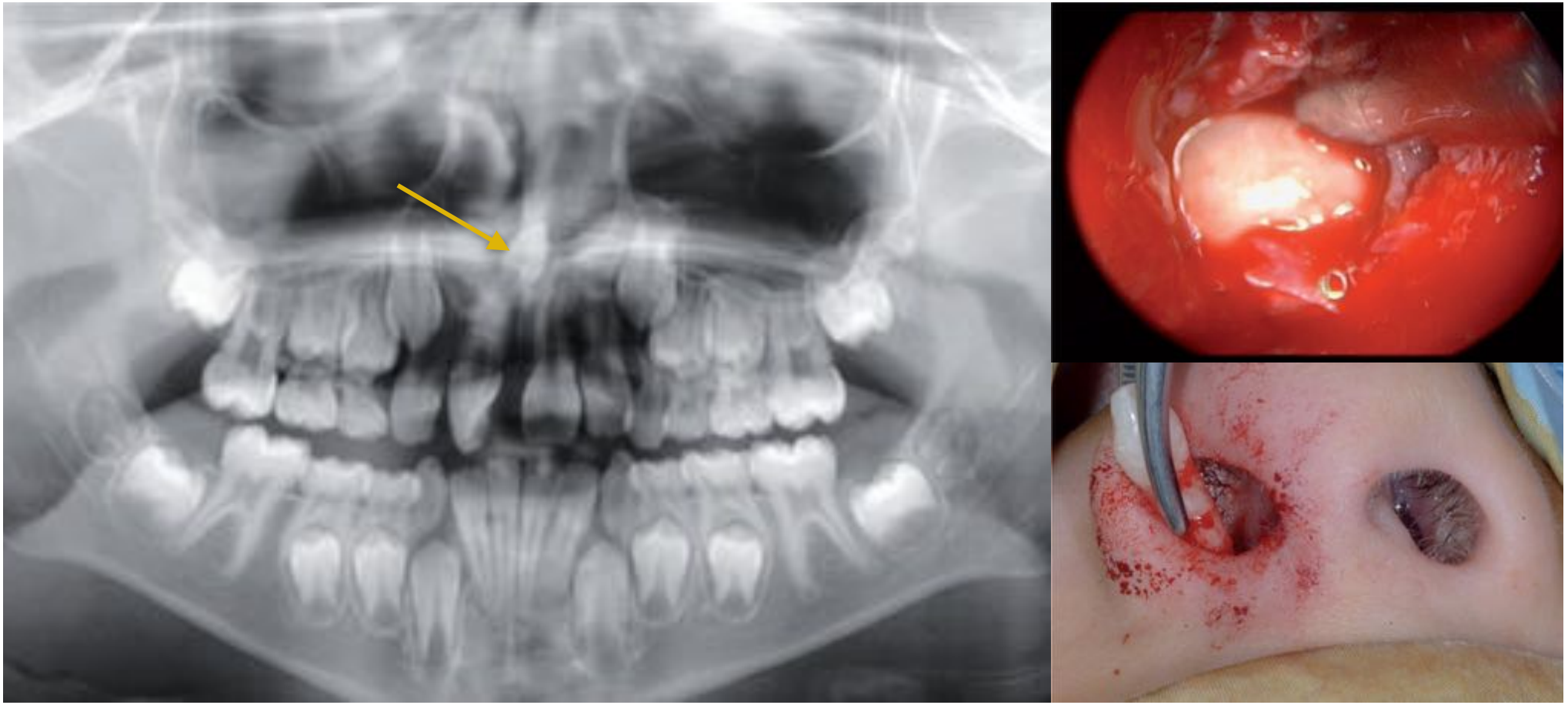
Complications

- Failure of eruption of permanent teeth
- Displacement or rotation or crowding
- Ectopic eruption of permanent teeth
- Abnormal diastema or premature space closure
- Dilaceration, delayed or abnormal root development of permanent teeth
- Pathology (dentigerous cyst formation)
- Rare complication
  - root resorption/loss of viability
  - nasal eruption

Endoscopic removal of supernumerary tooth from the nasal cavity of a child: a case report



Clementini et al 201

Hyperdontia

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Diagnosis

- Clinical - failed or eruption disturbance of permanent tooth
- Routine radiographic finding
- As part of a syndrome e.g. cleidocranial dysplasia

Treatment

- Depends on type and position of supernumerary
  - Long term monitoring
  - Extraction
  - Surgical removal

Hypodontia

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Definition

- Developmental absence of one or more teeth excluding third molars (Gooman, 1994)

Terminology

- Hypodontia: less than six missing teeth
- Oligodontia: six or more missing teeth
- Anodontia: no teeth present
- Agenesis of teeth associated with syndromes or systemic abnormalities

(Gorlin et al. 1978)

Hypodontia

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Classification

- Mild 1-2 missing teeth
- Moderate 3-5 missing teeth
- Severe 6 or more missing teeth (oligodontia)

(Goodman, 1994, Dhanrajjani, 2002; Jones, 2009)

Hypodontia

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Prevalence

- Most common congenital malformation

Primary dentition

- Uncommon
- 0.1-4.1% (Saito, 1959, Brook, 1974, Tongkoom, 1994)
- F = M
- Often associated with hypodontia in permanent dentition

Permanent dentition

- 4-6% Caucasian (Niswander and Sujaku, 1983; Brook, 1974; Tsai, 1996)
- F > M; F: M = 3:2 (Nunn, 2003; Larmour, 2005)
- Variation between continents, racial groups and gender (Polder, 2004)

(Brook, 1974; Tongkoom 1994; Tsai, 1996; McKeown et al. 2002: Khalaf et al. 2014)

Hypodontia

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Prevalence by the jaws and type of missing teeth

- Higher percentage of missing teeth in the maxilla (53.2%) than in the mandible (46.8%)
- The teeth most commonly missing are the last teeth in each series (namely the upper lateral incisors, the second premolars and third molars)

• Mandibular second premolars	29.9%
• Maxillary lateral incisors	24.3%
• Maxillary second premolars	13.7%
• Mandibular central incisors	6.1%
• Mandibular lateral incisors	4.3%
• Maxillary first premolars	3.6%
• Mandibular first premolars	2.7%
• Maxillary canine	2.5%
• Mandibular second molars	1.8%
• Maxillary second molars	1.5%
• Mandibular canines	1.3%
• Maxillary first molars	1.1%
• Mandibular first molars	1%
• Maxillary central incisors	1%

Khalaf et al. 2014

Hypodontia

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Prevalence by the jaws and type of missing teeth

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Table 5. Sequence of most to least affected teeth, divided in three main groups

	Prevalence (%)	Sequence
Common	1.5–3.1	$P2_i > I2_s > P2_s$
Less common	0.1–0.3	$I1_i > I2_i$ & $P1_s > C_s$ & $M2_I$
Rare	0.01–0.04	$M2_s$ & $M1_s > C_i > M1_i$ & $I1_s$

s, maxilla; i, mandible.

Polder et al 2004


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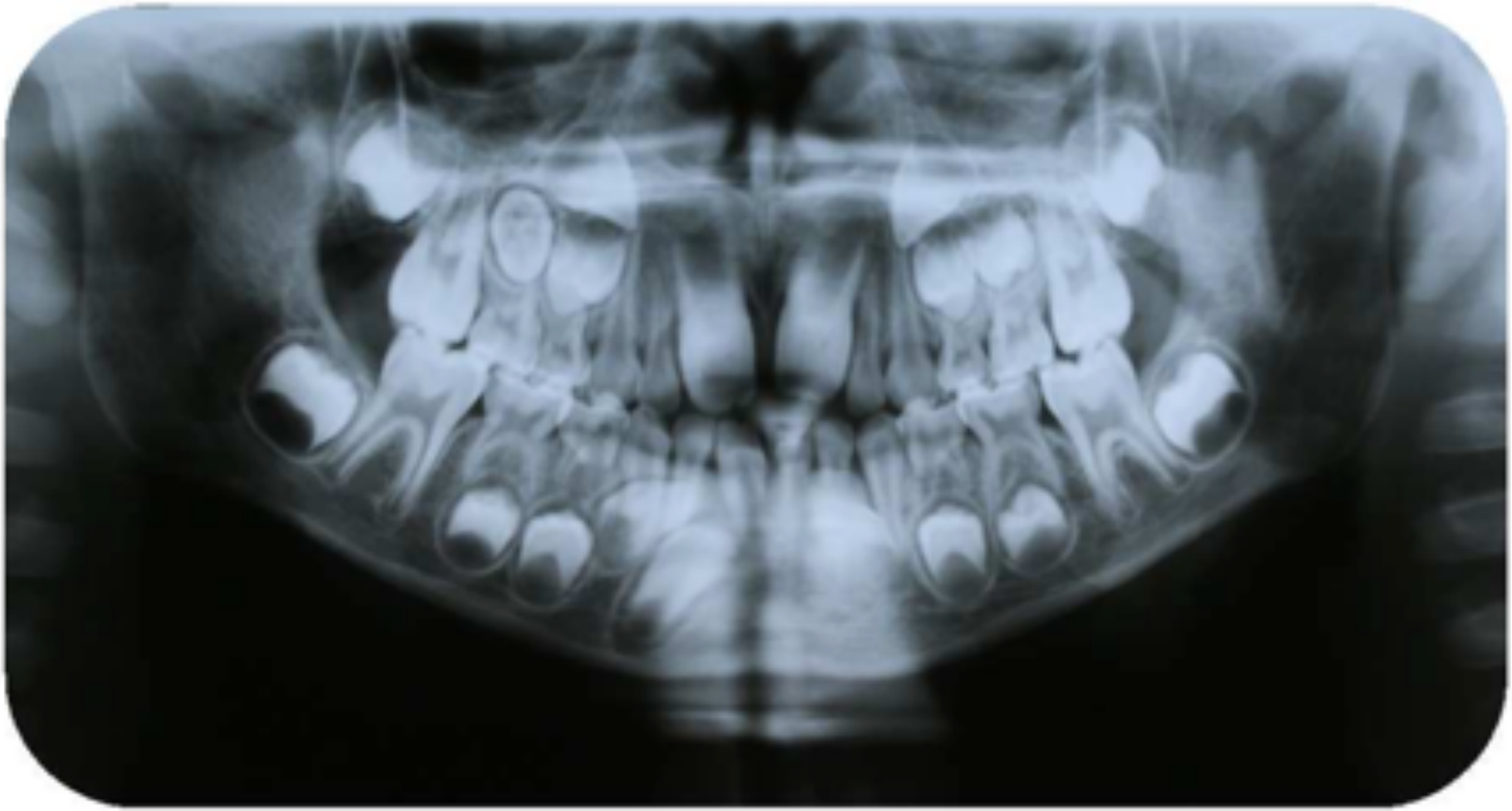

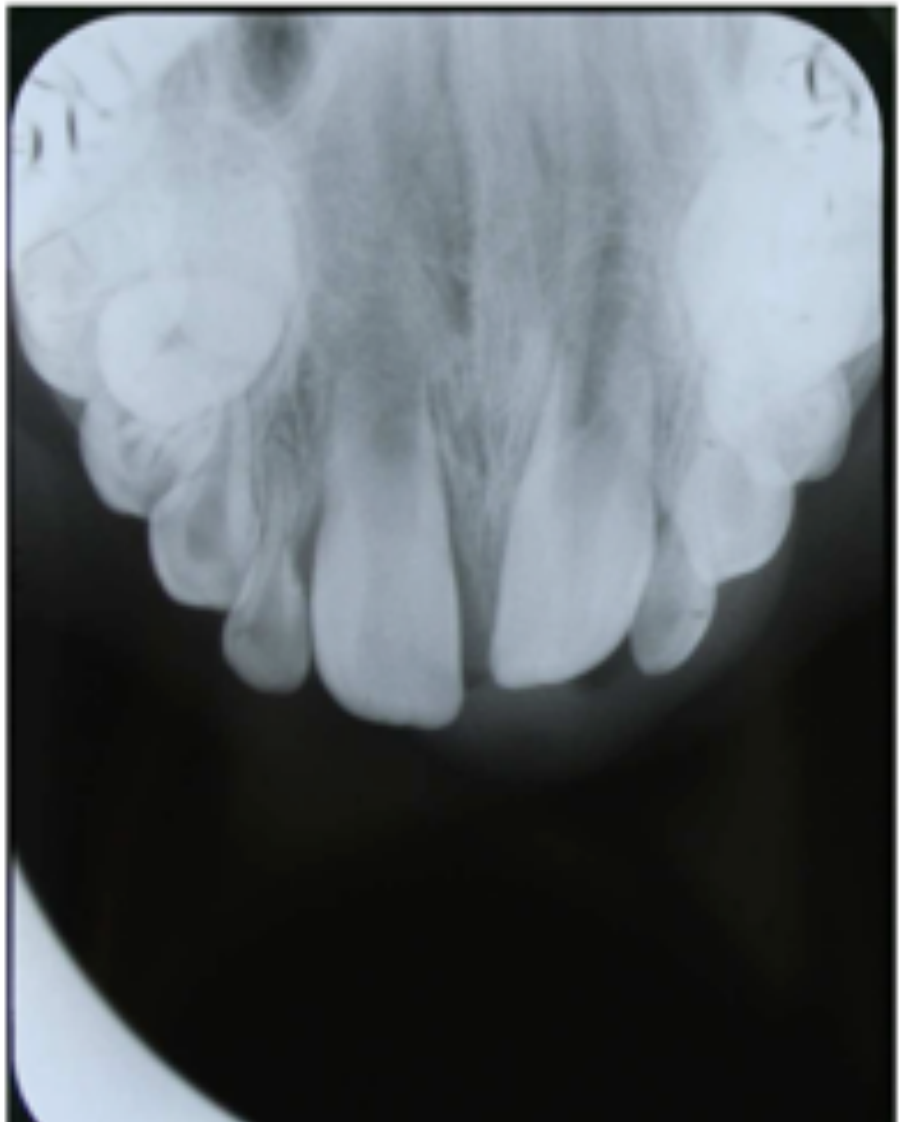

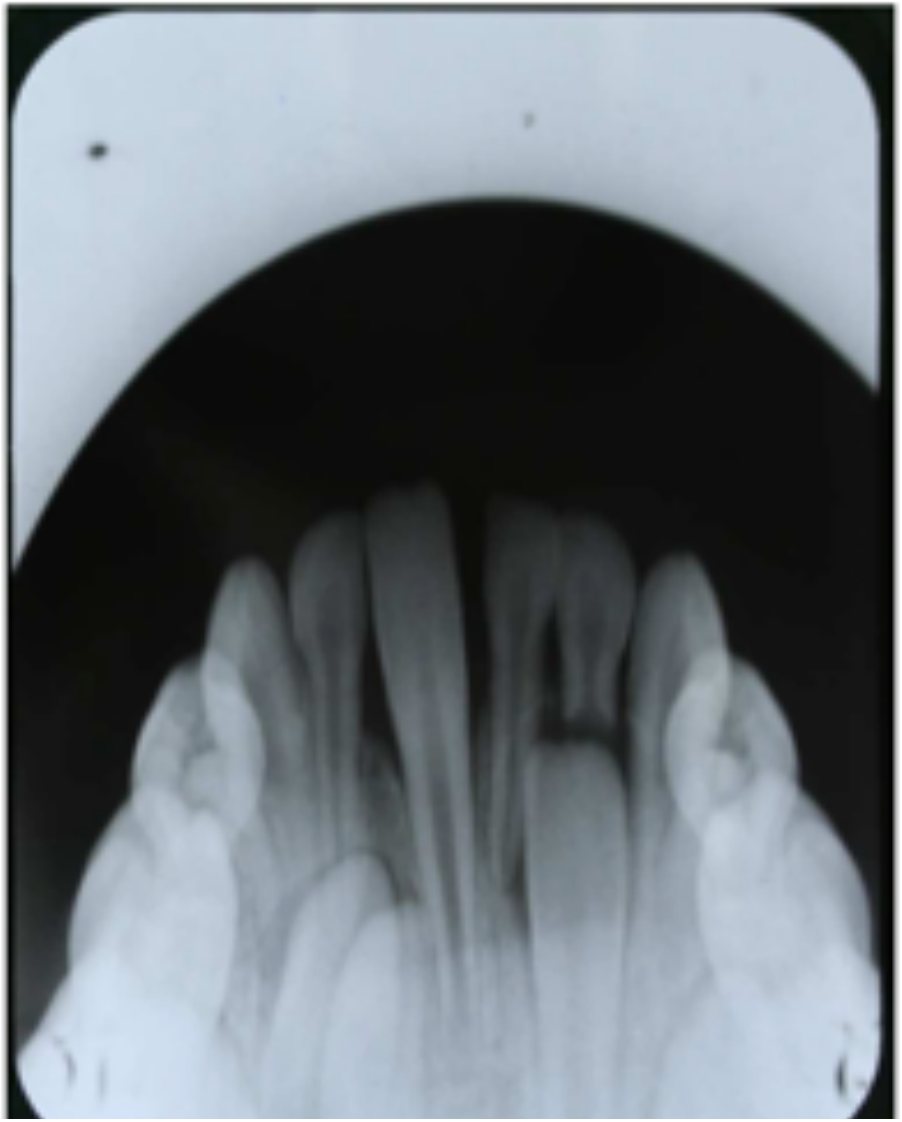

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Aetiology

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- Several theories – both genetic and environmental factors
- Hypodontia commonly associated with small teeth (Graber, 1978)
- It can be an isolated non-symdromic feature or a part of a complex syndrome

- Genetic basis in the majority of cases – Homeobox genes involved
  - MSX1
  - PAX9
  - AXIN2 (Cobourne, 2007)

- Environmental factors
  - Intra-uterine effects of drugs e.g. Thalidomide
  - Early radiotherapy & chemotherapy
  - Trauma e.g. alveolar fracture or jaw fracture, jaw surgery, iatrogenic damage to the permanent tooth germ from traumatic extraction of overlying primary tooth
  - Infection e.g Rubella

(Winter, 1996; Brook et al. 2009)

Hypodontia

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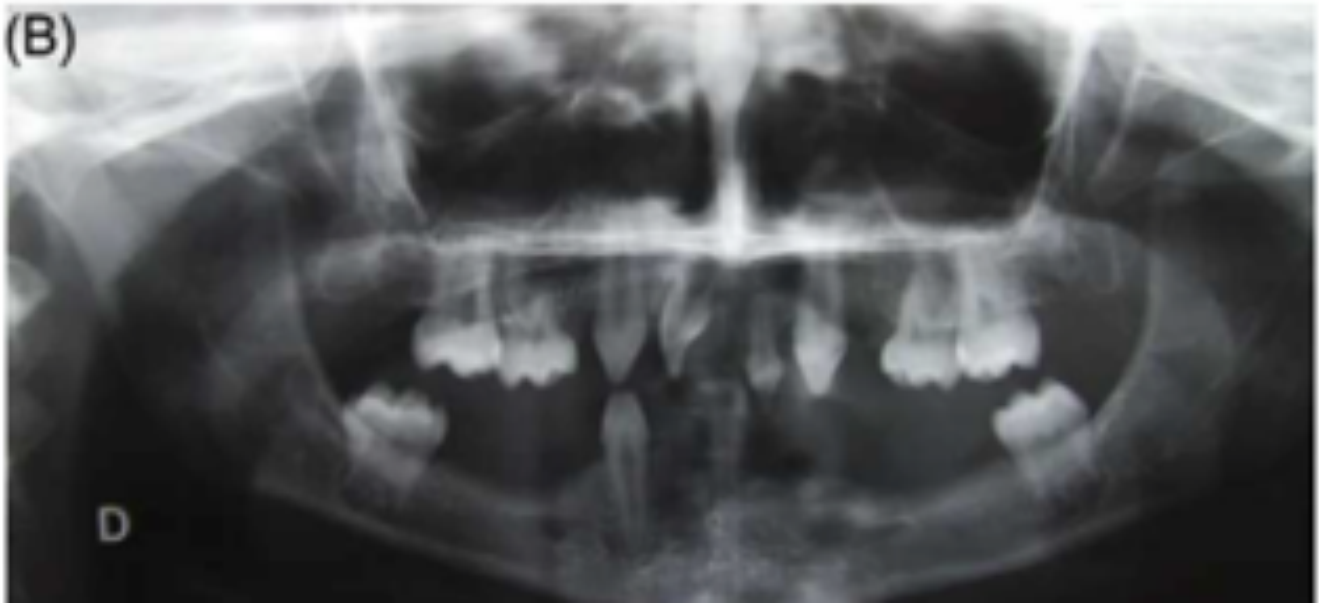
Hypodontia is a major clinical feature of over 50 syndromes including:

- Hypohidrotic Ectodermal Dysplasia (HED)
- Hypohidrotic Ectodermal Dysplasia with Immune Deficiency (HED-ID)
- Dento-alveolar clefting
- Trisomy 21 (Down syndrome
- Oral–Facial–Digital Syndrome Type I (OFDI)
- Williams (Beuren) Syndrome (WBS)
- Solitary Median Maxillary Central Incisor (SMMCI)
- Axenfeld–Rieger Syndrome (Rieger Syndrome)
- Oligodontia and Colorectal Cancer Syndrome
- Odonto-Onycho-Dermal Dysplasia (OODD)
- Incontinentia Pigmenti
- Wolf–Hirschhorn Syndrome
- Witkop Syndrome

Hypodontia

Hypohidrotic
Ectodermal
Dysplasia



Hypodontia

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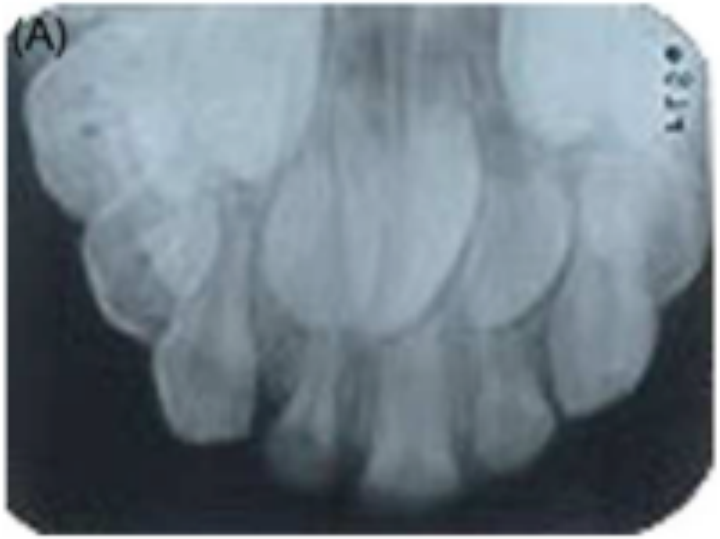
Hypodontia associated with syndromes

- Ectrodactyly, Ectodermal Dysplasia and Clefting (EEC)
- Ellis-van Creveld Syndrome (EVC)
- Weyers Acrofacial Dysostosis Syndrome (Curry–Hall Syndrome)
- Van der Woude Syndrome (VWS)
- Angel-Shaped Phalango Epiphyseal Dysplasia (ASPED)
- Lacrimoauriculodentodigital Syndrome (LADD)
- Kallmann Syndrome (KS; KAL2)
- Bloom Syndrome (BS, BLS)
- Rothmund–Thomson Syndrome
- Diastrophic Dysplasia Syndrome
- Johanson–Blizzard Syndrome
- Kabuki Syndrome



Solitary Median
Maxillary Central
Incisor syndrome

Clinical Features

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- Delayed/asymmetric eruption of permanent teeth
- Retained or infraoccluded deciduous teeth
- Absent deciduous teeth
- Can be associated with short root anomaly

- Patients with hypodontia often present a tendency to
  - Lip protrusion (Chung, 2000)
  - Increased overbite
  - Increased rotations of teeth (Bacetti, 1998)
  - Increased prevalence of ectopic maxillary canines
  - Reduced mandibular plane angle

Hypodontia

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Treatment

- Acid-etch retained, composite resin build-ups of conical teeth
- Orthodontic management of spaces
- Removable prosthesis
  - Partial dentures
  - conventional dentures
  - overdentures
- Fixed prostheesis
  - composite resin veneers
  - crowns
  - bridges
- Autotransplantation
- Osseointegrated implants (usually after the cessation of growth).

ANOMALIES OF TOOTH SIZE

Microdontia

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Definition: It is described as teeth which are smaller than normal and outside the usual limits of variation

(Rushton, 1948)

- In general microdontia, the teeth are small, the crowns short, and normal contact areas between the teeth are frequently missing (Boyle, 1955)

- Alternative terminology (Shafer et al. 1974)
  - Microdentism
  - Microdontism

Microdontia

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Prevalence

- Permanent dentition > primary dentition (Shafer, 1974)
- Female > male (Brook, 1974, Tongkoom, 1994; Tsia, 1996)
- More frequently in the maxillary teeth than the mandibular teeth
- Most prevalence data are available only for maxillary lateral incisors

Primary dentition

- 0.5- 6.3% (Brook, 1974; Tongkoom, 1994; Ooshima et al. 1996)

Permanent dentition

- 1.9- 6.9% (Brook, 1974; Ooshima et al. 1996; Tsai, 1996; Aldred et al. 2012)

Microdontia

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Classification

- True generalised microdontia
- Generalised relative Microdontia
- Localised microdontia

(Shafer et al. 1958)

Microdontia

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True generalised type

- All the teeth are smaller than normal
- All of the teeth are of a normal morphological form
- Exceedingly rare
- Reported in
  - radiation or chemotherapeutic treatment during the developmental stage of the teeth (Van der waal, 1988)
  - pituitary dwarfism (Shafer, 1958)
  - fanconi's anemia (Opinya et al. 1988)

Microdontia

Microdontia

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Generalised relative Microdontia

- Normal or slightly smaller than normal teeth but the jaws are somewhat larger than normal – impression of microdontia

Microdontia

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Localised microdontia

Involving a single tooth & further subdivided into:

1. Microdontia of the whole tooth
2. Microdontia of the crown of the tooth
3. Microdontia of the root alone

(Ufomata, 1988)

- Rather common
- Affects mostly the maxillary lateral incisor (Peg-shaped laterals)
- Supernumerary teeth are frequently small in size

Microdontia

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- Common form in lateral incisors – PEG laterals
  - The mesial and distal surfaces converge or taper incisally forming a peg-shaped or cone-shaped crown
  - The roots are frequently shorter than normal

Microdontia

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Conditions and syndromes associated with microdontia

- Patients with ectodermal dysplasia often present with microdontia
- Pituitary dwarfism
- Down syndrome
- Facial Hemiatrophy
- Gorlin-Chaudhry-Moss syndrome
- Williams's syndrome
- Chromosome d/u, 45X [Ullrich-Turner syndrome]
- Chromosome 13 [trisomy 13]
- Rothmund-Thomson syndrome
- Hallermann-Streiff
- Orofaciodigital syndrome (type 3)
- Oculo-mandibulo-facial syndrome
- Tricho-Rhino-Phalangeal
- type1 Branchiooculo- facial syndrome

Microdontia

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Treatment

- Composite resin build-up
- Porcelain veneers
- Ceramic crown
- Cast restoration
- Orthodontic alignment and extraction of the tooth
- Autotransplantation
- Extraction and implants

Macrodontia

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Definition

- Tooth size that is outside the usual limits of variation for that type (Shafer et al. 1974)

- **Terminology**:
  - Megalodontia
  - Megadontia
  - Gigantism (Shafer et al. 1974; Dugmore, 2001)

- For practical purpose this is a tooth that is 1 mm larger than their antimere or the mean dimension of the tooth, and exhibits normal crown, root and pulp morphology (Chaudhary et al. 1997)

- The affected teeth may be of normal or abnormal morphology

Macrodontia

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Prevalence

- Male > Female

  (Brook, 1974; Tonghkoom, 1994; Oashima et al. 1996; Tsai, 1996)

- Primary dentition: 0-2.3%

  (Brook, 1974; Tonghkoom, 1994; Oashima et al. 1996)

- Permanent dentition: 1.1-3.6%

  (Brook, 1974; Oashima et al. 1996; Tsai, 1996)

Macrodontia

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Classification

- True generalised macrodontia
- Generalised relative macrodontia
- Localised macrodontia

(Shafer et al. 1958; Nemes and Alberth, 2006; Dugmore, 2001)

Macrodontia

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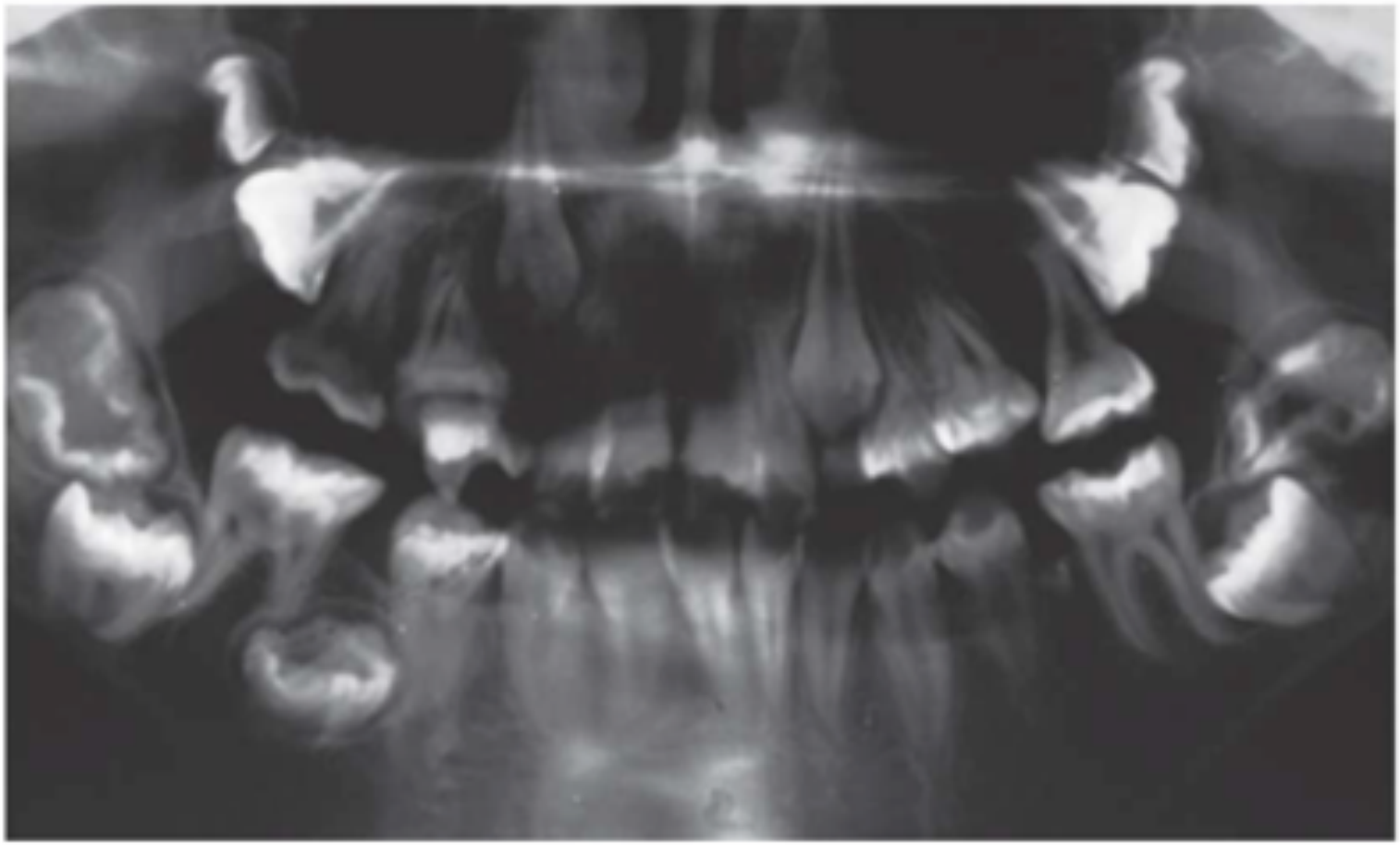
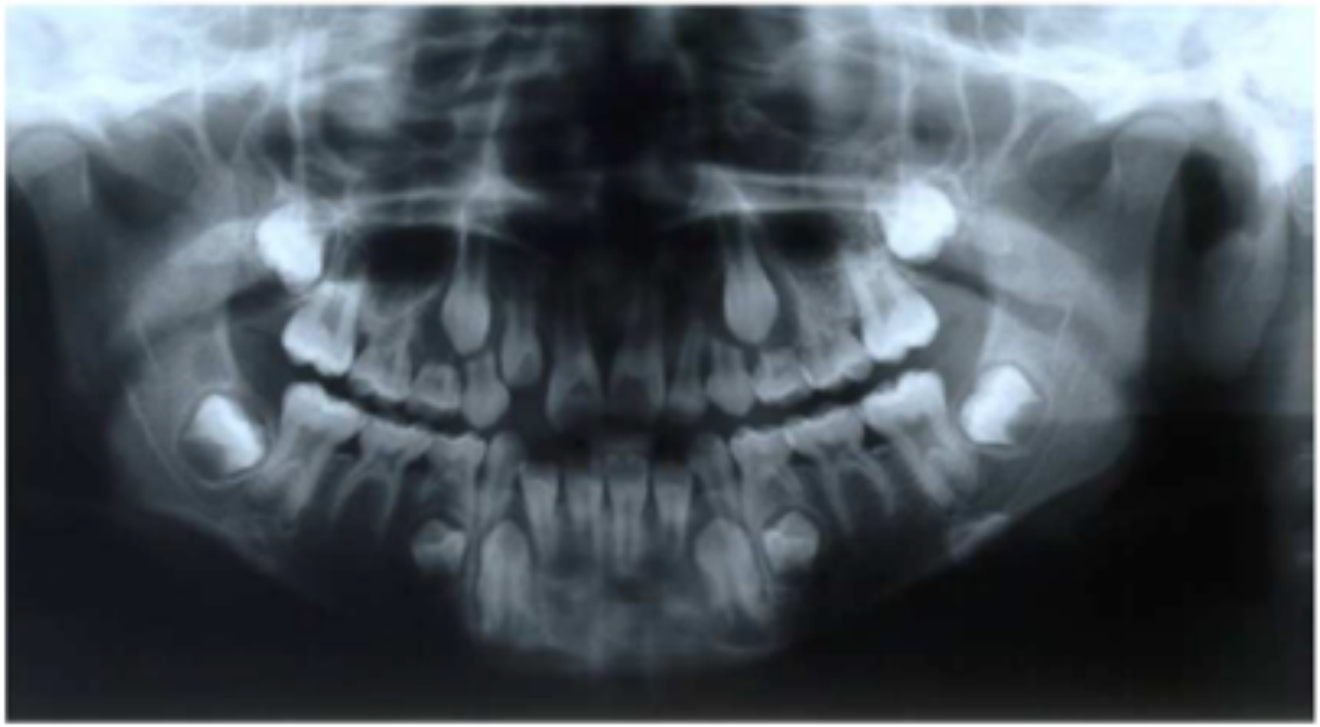
- **True generalized type**
  - Extremely rare
  - All or at least multiple teeth are larger than normal
  - Associated with
    - Pituitary gigantism
    - Hemifacial hyperplasia
    - Otodental syndrome
    - Klinefelter syndrome
    - KBG syndrome (Herrmann-Pallister-Opitz Syndrome)
    - Pineal hyperplasia with hyperinsullinism

Generalised macrodontia



Generalized macrodontia associated with KBG syndrome

Macrodont permanent upper central incisors in KBG syndrome



Large incisors in a boy with Klinefelter syndrome

Macrodontia

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- **Generalized relative type**
  - Some what more common
  - Normal or slightly larger sized teeth in smaller jaws
  - An illusion of generalized macrodontia
  - Hereditary factors

Macrodontia

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Isolated macrodontia

- Involving a single tooth
- Relatively uncommon
- Unknown etiology
- Tooth may appear normal in every aspect except for its size

- Frequently reported in
  - incisors
  - canines
- Can be seen in
  - second mandibular premolars
  - mandibular molars or premolars
  - third molars

Dugmore, 2001;Kumar, 2009; Almandey et al. 2010

Isolated macrodontia in a mandibular second premolar tooth

Macrodontia

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Complications

- Problems with aesthetics
- Arch length discrepancies
- Crowding
- Disruption of the developing occlusion
- Teeth predispose to caries

Macrodontia

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Treatment

- Stripping of the macrodont
- Stripping combined with composite resin build-up of the antimere if only one tooth affected

- Extraction and replacement by
  - fixed prosthesis
  - removable prosthesis
  - implant

- Autotransplantation

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Thank You