

# MECHANISM OF SECOND DENTITION

Dr. Macsali Réka

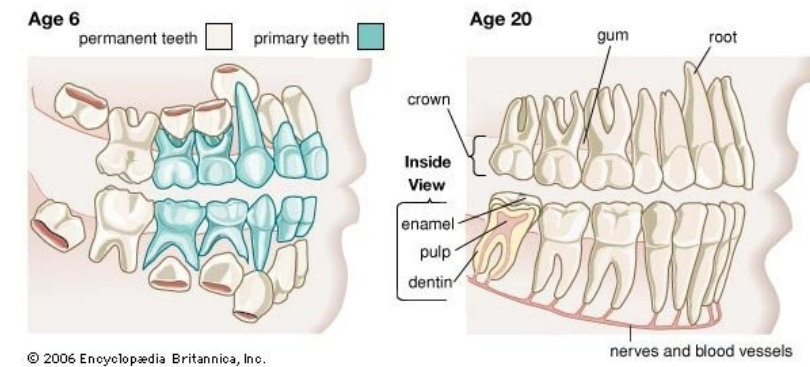
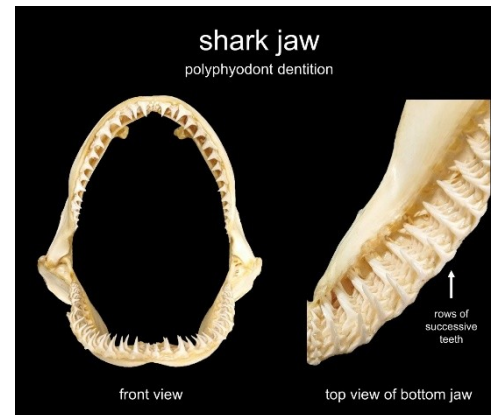
SEMMELWEIS UNIVERSITY  
DEPARTMENT OF PAEDIATRIC DENTISTRY AND ORTHODONTICS



SEMMELWEIS  
EGYETEM 1769

# Diphyodont and Heterodont humans

- homodont: all tooth are alike;
- *heterodont: teeth have diferent shapes;*
- polyphyodont: changing of teeth for the whole lifetime
- *diphyodont : 2 sets of teeth – mammals;*



# Development of the permanent teeth

- The germs of the permanent teeth develop on the lingual or palatal side of the milk teeth in the 3rd month of pregnancy
- As the jawbone grows, the dental ridge moves behind the second milk molar in the 4th month.
- In this area, the germs of the remaining teeth appear in mesiodistal order:
  - M1: ~ 16th week in utero.
  - M2: ~ 1 year of life
  - M3: ~ 5 years of ageThe teeth do not develop at the same time!
- The development of milk teeth and permanent teeth are spatially and temporally separated! - CARIES!
  - Calcification: deciduous teeth prenatal, permanent teeth predominantly postnatal.

# Development of the permanent teeth

- Each dental crown develops 4 or more growth centres
- 3 labial, 1 palatal/lingual growth centres
- Growth lines or grooves indicate the convergence of the centres
  - The cusps of the molars always develop from one growth centre



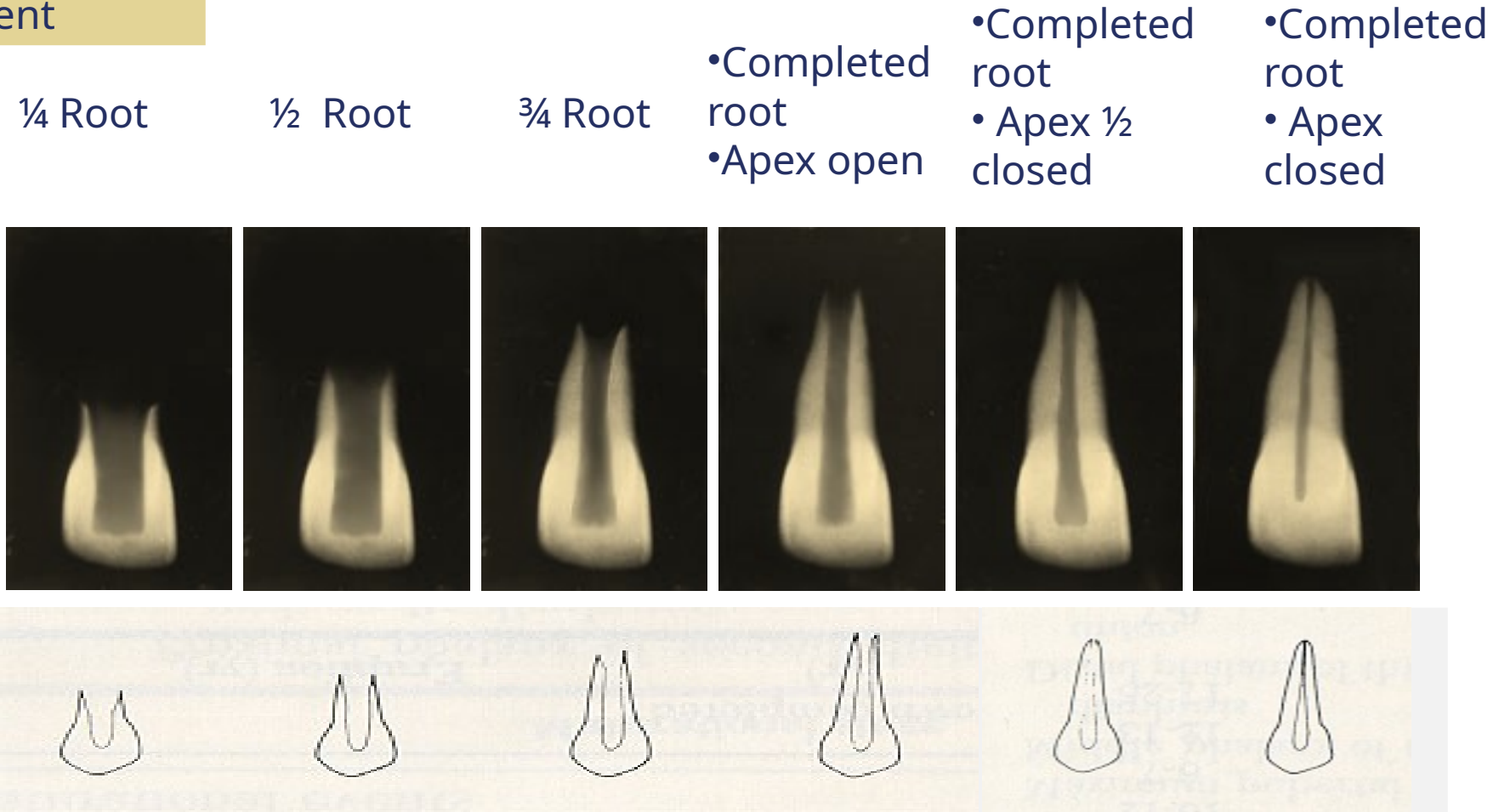
lower first permanent molar



upper second permanent molar

# Root development - *MOORREES et al.*

7 stages of root development



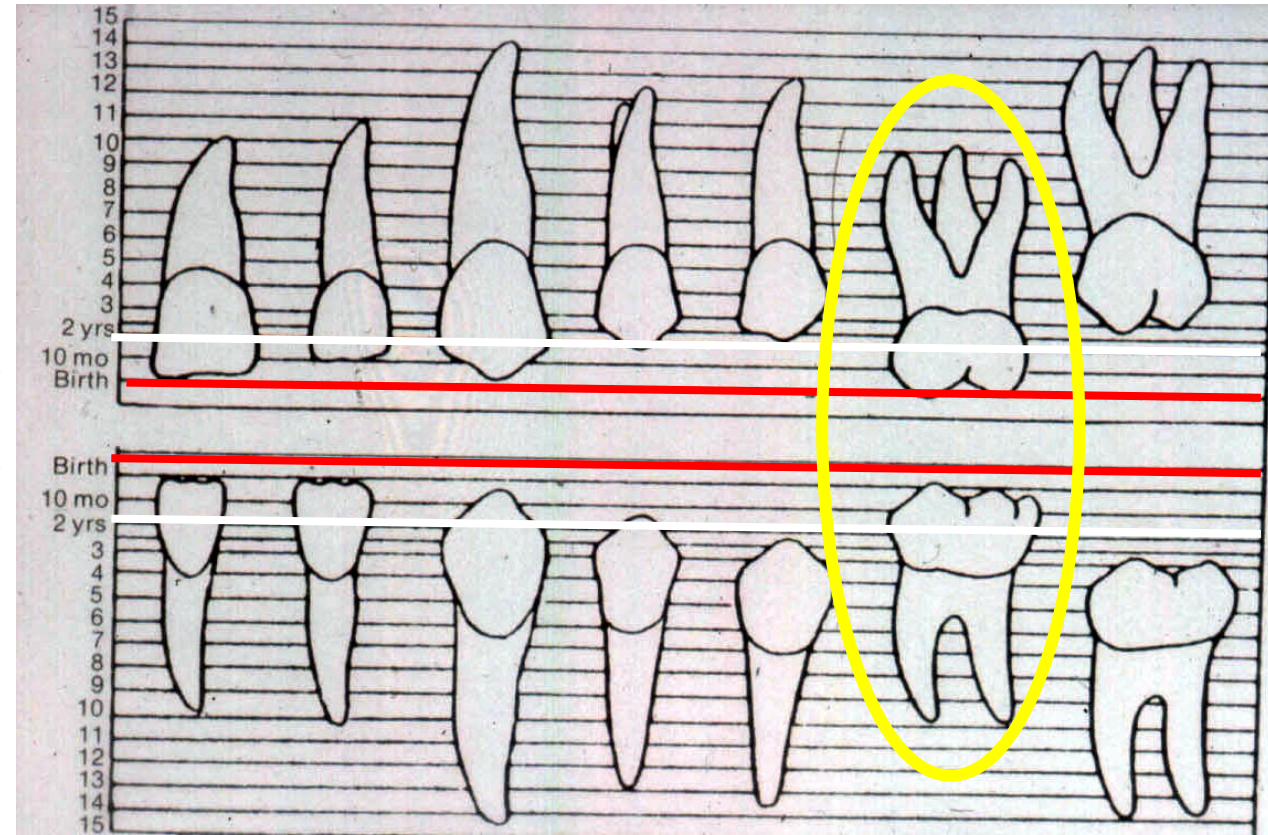
MOORREES CF, FANNING EA, HUNT EE Jr. AGE VARIATION OF FORMATION STAGES FOR TEN PERMANENT TEETH.  
J Dent Res. 1963 Nov-Dec; 42:1490-1502.



# Mineralisation in the permanent dentition

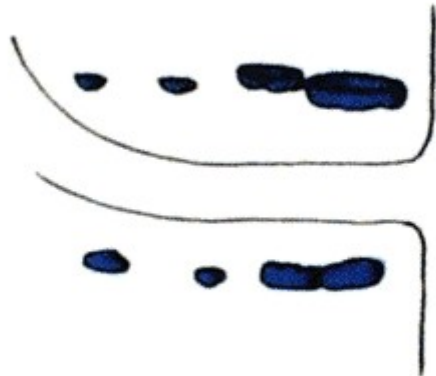
- Great individual variability
- Birth: cusps of the first molars
- 1st year of life: incisal edges of the frontal teeth
- 2 ½ years: cusps of first molars are completed, incisor crowns halfway, cusps of canines and premolars
- 4th year of life: crowns of first molars and incisors are completed, canine crown halfway, cusp of PM and 2nd molars
- runs parallel to the vertical development of the teeth
- Root growth continues for up to 3 years after eruption of the permanent teeth
- Wisdom tooth: 5th-8th year of life (early), 10th-13th year of life (general) or even later

Birth



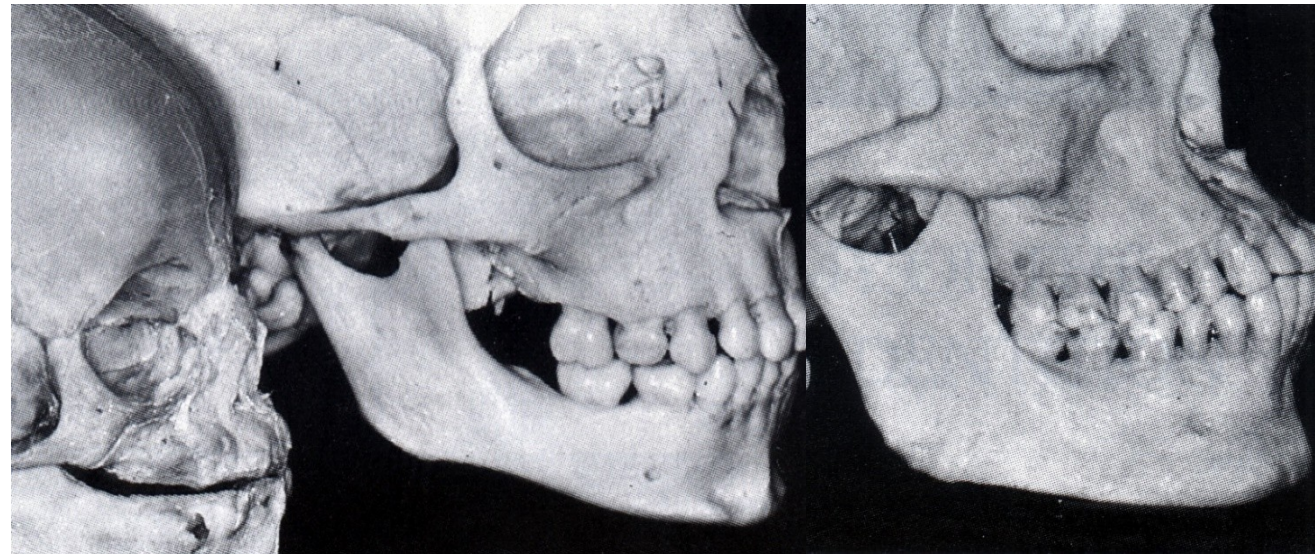
# SECOND DENTITION -MECHANISM

- Mechanism – several factors responsible for normal second dentition process
- Primary teeth period, after development of primary teeth – transitory period: maxillary bones are preparing for the permanent teeth arrival.



# SECOND DENTITION

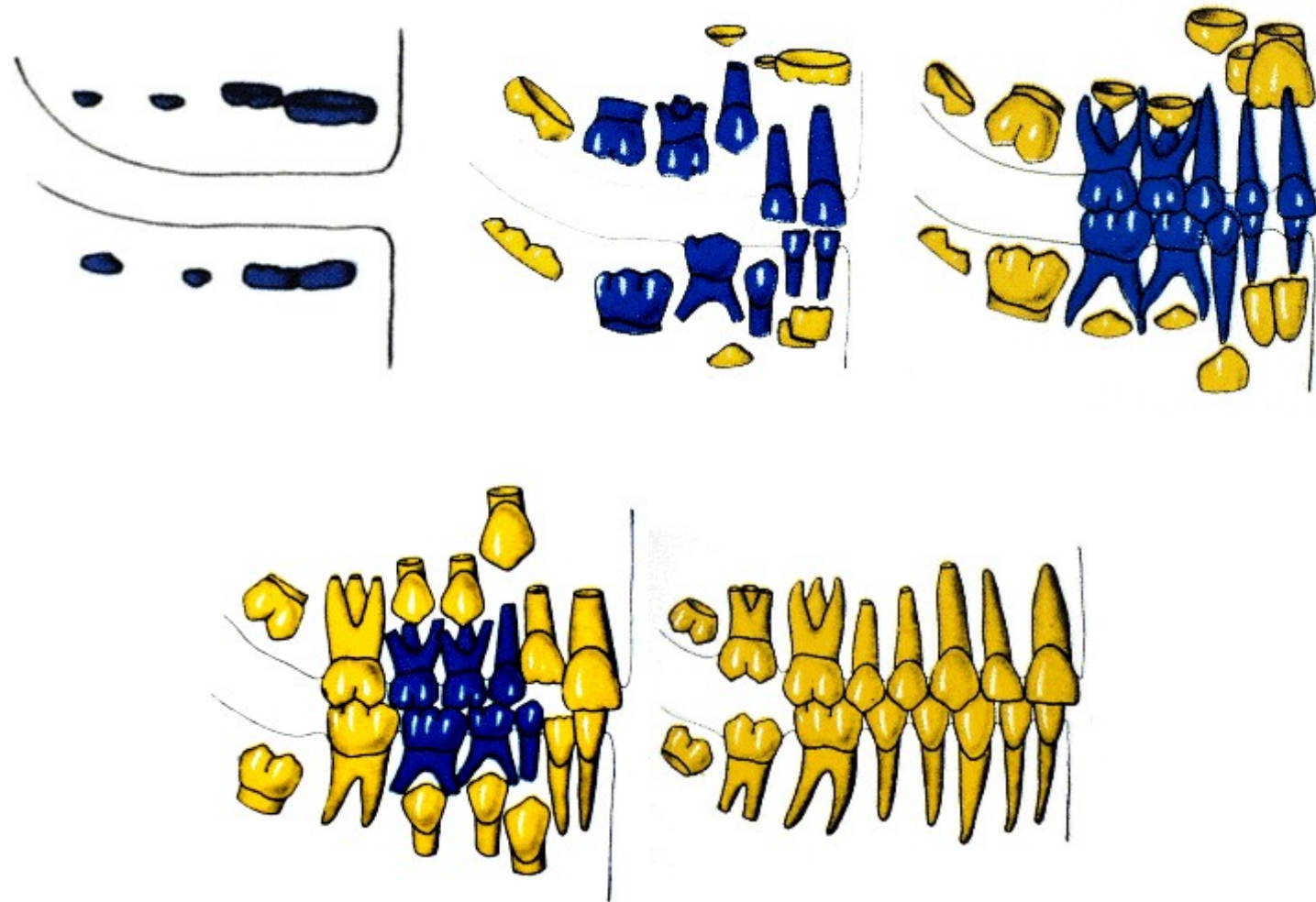
- A physiological development process in which the tooth is placed in the oral cavity, reaches its final position and enters into occlusion with the antagonist.
- Dynamic process in the course of which root development is completed, periodontal development and functional occlusion are formed.



(J.R. Pinkham: Pediatric Dentistry, Elsevier Saunders, St. Louis, 2004)

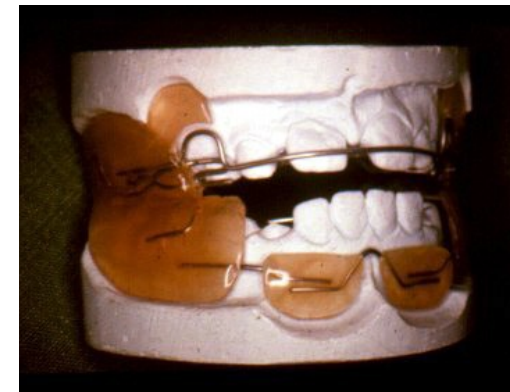


# Eruption



# The importance of second dentition

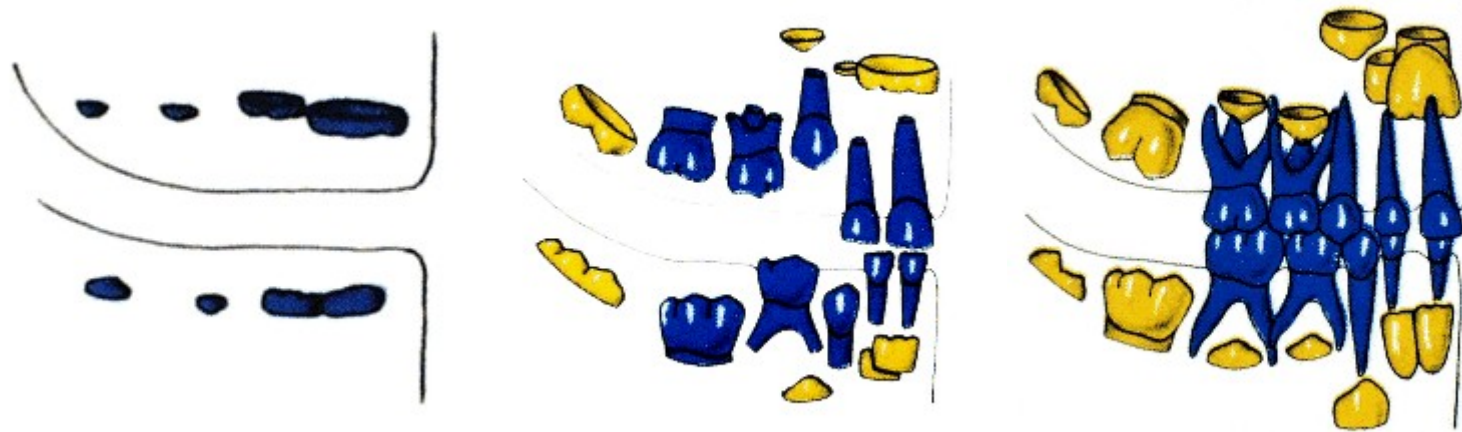
- influences the normal development of the craniofacial complex.
- influences the patient's dental care, the start time of orthodontic treatment, the method and duration of treatment.
- may also be important for the proper care of the patient.



(J.R. Pinkham: Pediatric Dentistry, Elsevier Saunders, St. Louis, 2004)

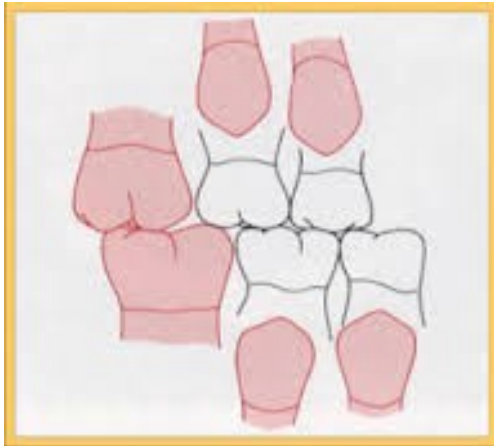
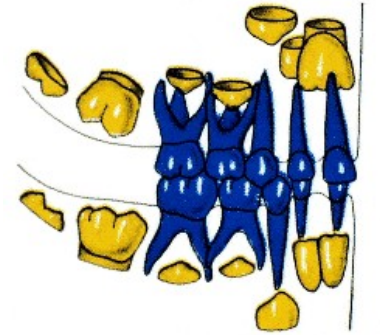
## ~ 6 years M<sub>1</sub>

- First permanent molars: at the end of the line;
- „Sechsjahrmolaren”;
- There are no changing of teeth, so it goes often unnoticed by the parents!
- *occlusion: singular/double antagonism*
- *secon physiological raising of the occlusion*



## ~ 6 years M<sub>1</sub>

- The first permanent molars erupt at the end of the dental arch without changing milk teeth - completing the row of teeth;



6 éves

9 éves

10 éves



# Second dentition

## Condition of the milk teeth

- Cariogenic environment
- Contact caries
- occlusal/approximal surfaces.
- undermining resorption,



# Second dentitions- timing



Permanent teeth	Hidasi	Fehér
<b>1. Molars (6)</b>	<b>6</b>	<b>6-7</b>
<b>Mesial incisors</b>	<b>8</b>	<b>6-8</b>
<b>Lateral incisors</b>	<b>8</b>	<b>7-9</b>
<b>Canines</b>	<b>11</b>	<b>9-12</b>
<b>1. and 2. Praemolars</b>	<b>9-10</b>	<b>10-12</b>
<b>2. Molars (7)</b>	<b>12</b>	<b>11-13</b>
<b>3. Molars (8)</b>	<b>-</b>	<b>17-21</b>



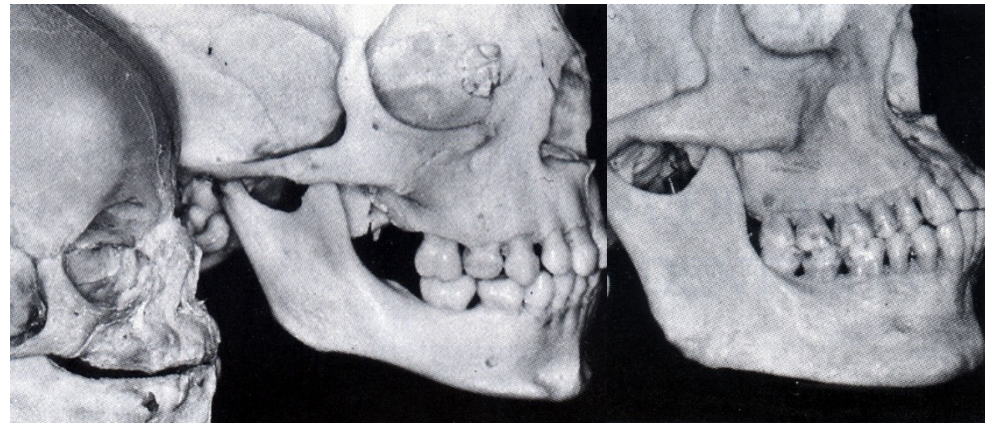
Upper jaw	Sequence
♂	4→5→3
♀	3→4→5 or 4→3→5

Lower jaw	Sequence
♂, ♀	3→4→5

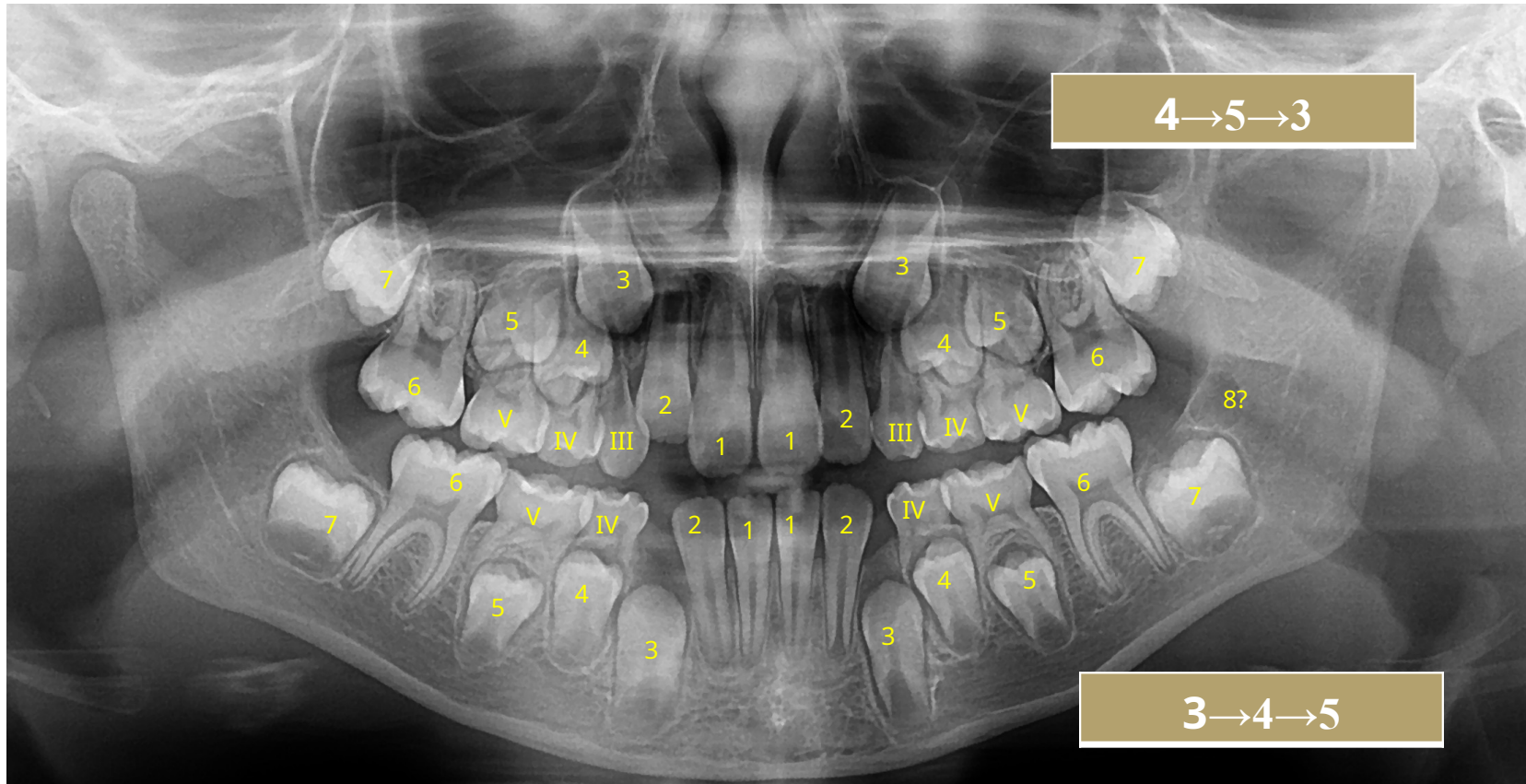


# CHARACTERISTIC

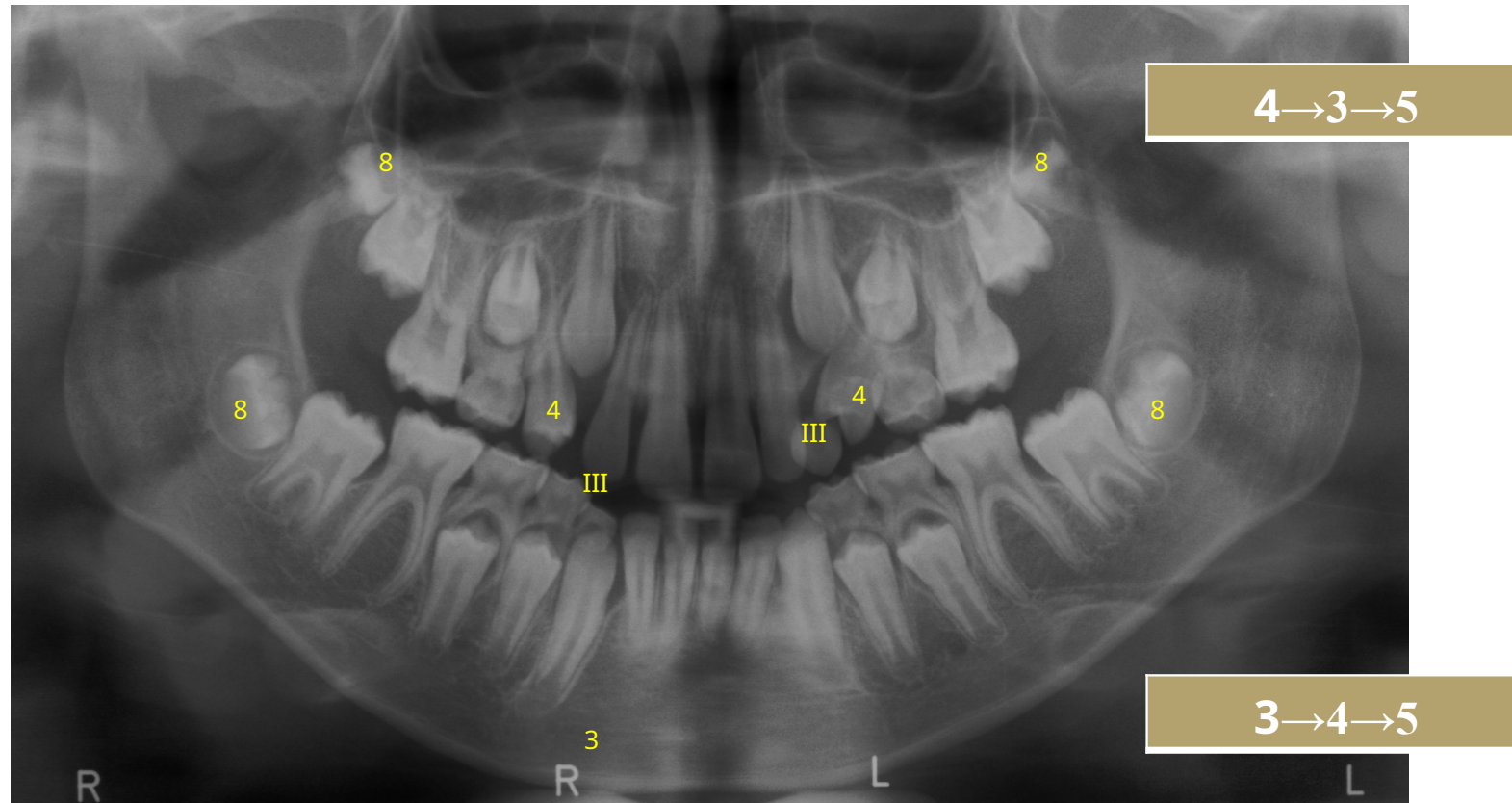
- ***Percentil presence of permanent teeth:*** prevalence of a particular tooth at a given moment in the population.
  - differences between the arches;
  - sexual dimorfizm;
  - dental age determination!;
  - dental status or the given age.







# 8-9 yaers old



# CHARACTERISTIC

• *Average eruption time*: the age, when the *percentil presence* of the tooth is 50%.

## IMPORTANCE:

- describes the second dentition process;
  - comparative studies between populations;
  - *acceleratio*: comparison with older data!;
- 
- ✓ Percentil presence: tooth type 15-40%
  - ✓ Average eruption time: tooth type 1-1,5 years.

# SECOND DENTITION-BONE MATURATION

- The second dentition usually runs parallel to bone maturity: if the biological age, which is based on bone maturity, differs from the calendar age, the course of the change of teeth will also be different from the average.
- Determination of bone maturity or bone age: Hand X-ray
  - Tanner-Whitehouse method TW2 (Tanner et al. 1975)
    - The image is used to compare the developmental status of the bone with a standard series of images - orthodontic diagnostics!





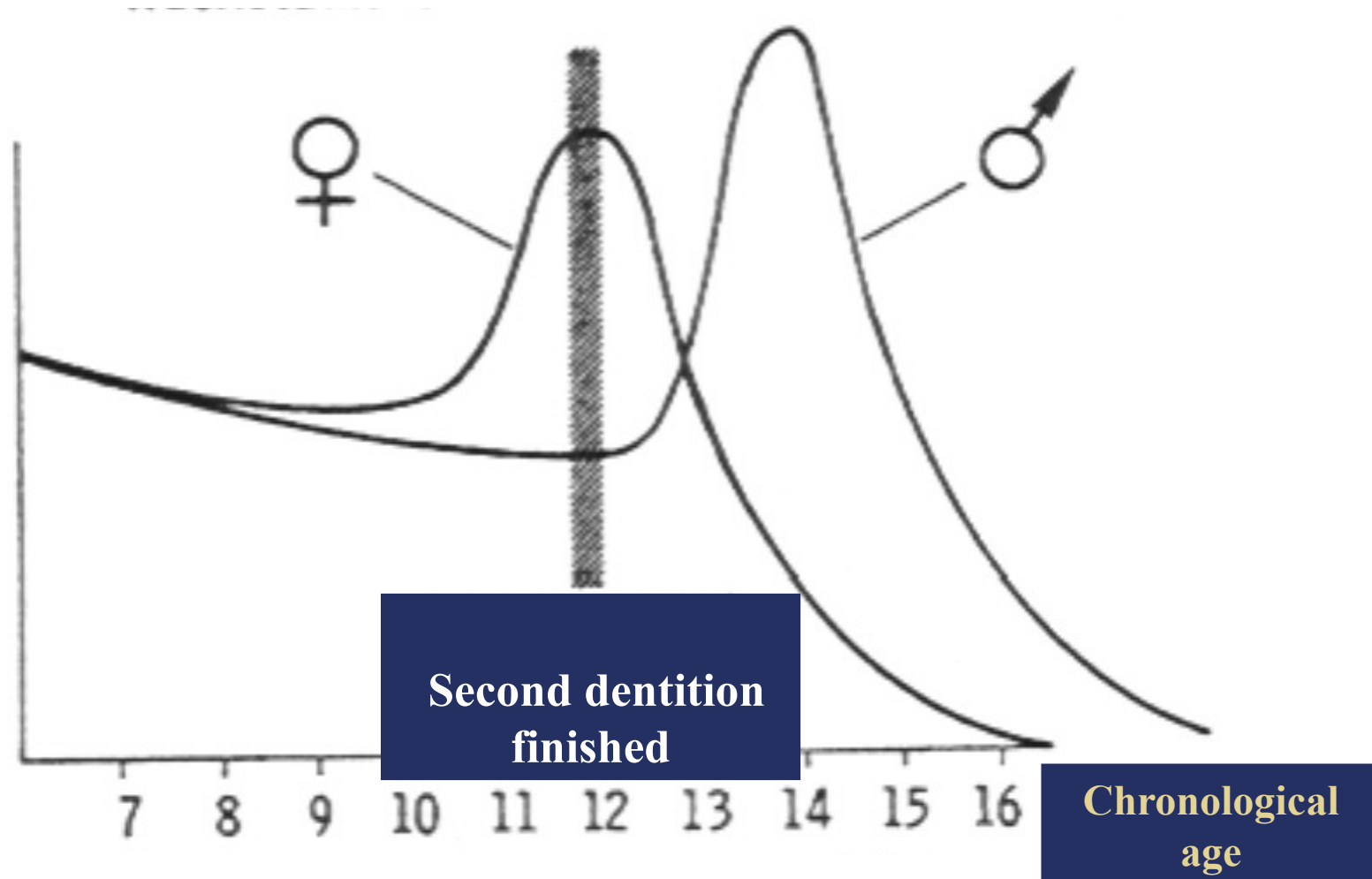
# BONE MATURATION



14 years old girl      21 years old boy



# GROWTH- TANNER



# CVMS – cervical vertebrae maturational status



CVMS 1

CVMS 2

CVMS 3

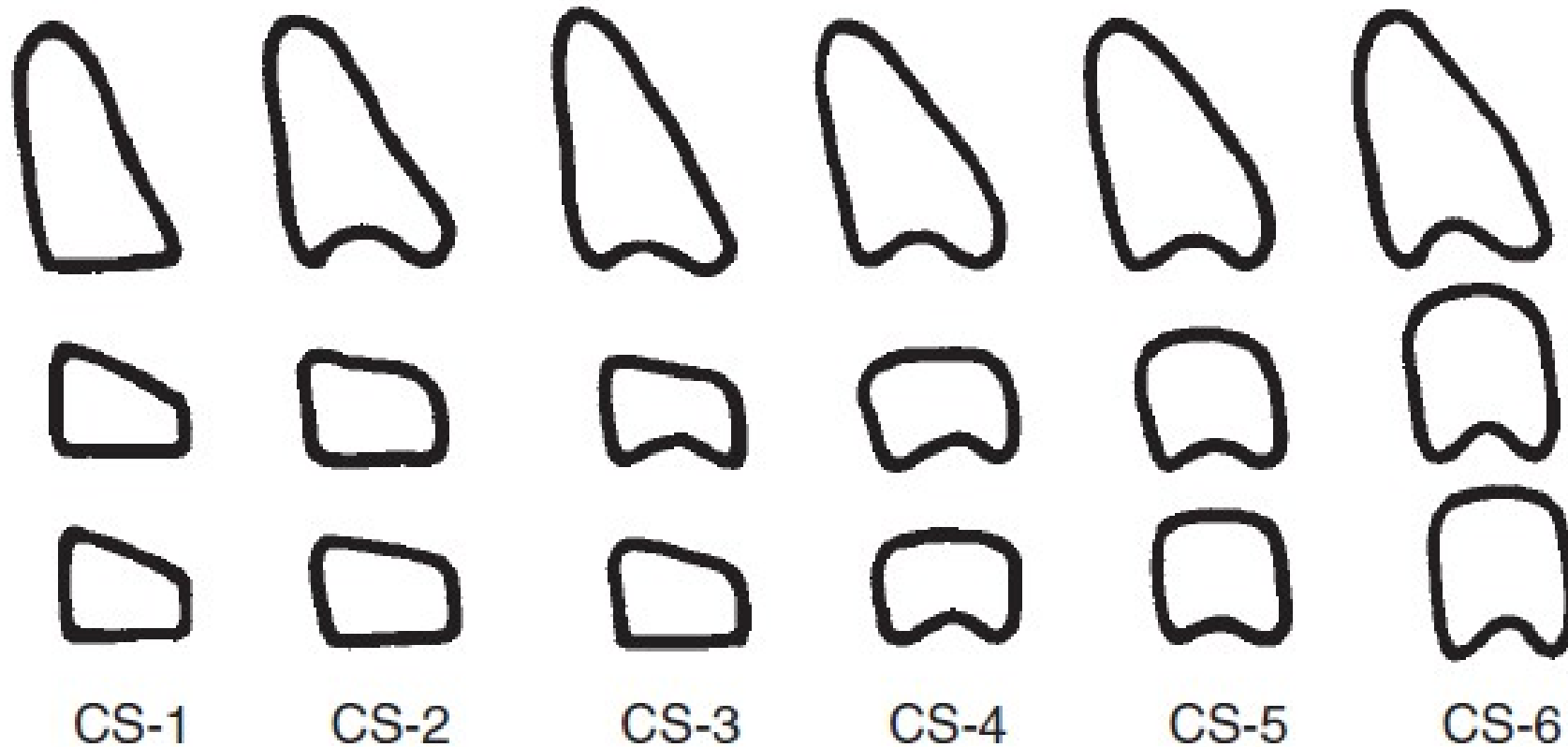
CVMS 4

CVMS 5

CVMS 6

Graber, Contemporary Orthodontics 2012. Ch 14. Optimizing Orthodontic and Dentofacial Orthopedic Treatment Timing

# Determination of the skeletal age



Graber, Contemporary Orthodontics 2012. Ch 14. Optimizing Orthodontic and Dentofacial Orthopedic Treatment Timing



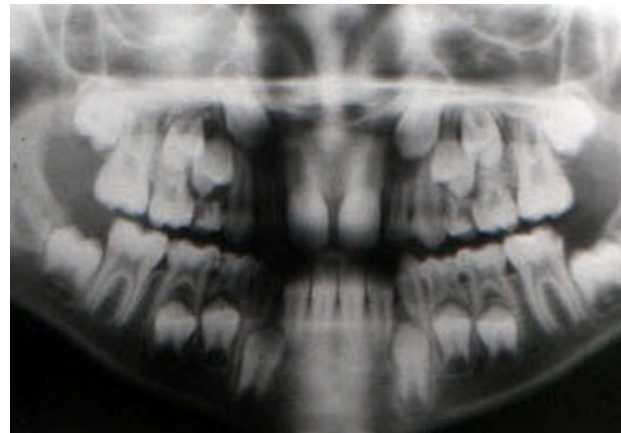
# SECOND DENTITION CRITERIA

- Presence of the permanent toothgerm
- Optimal position of the toothgerm
- Sufficient space
- Physiological root resorption



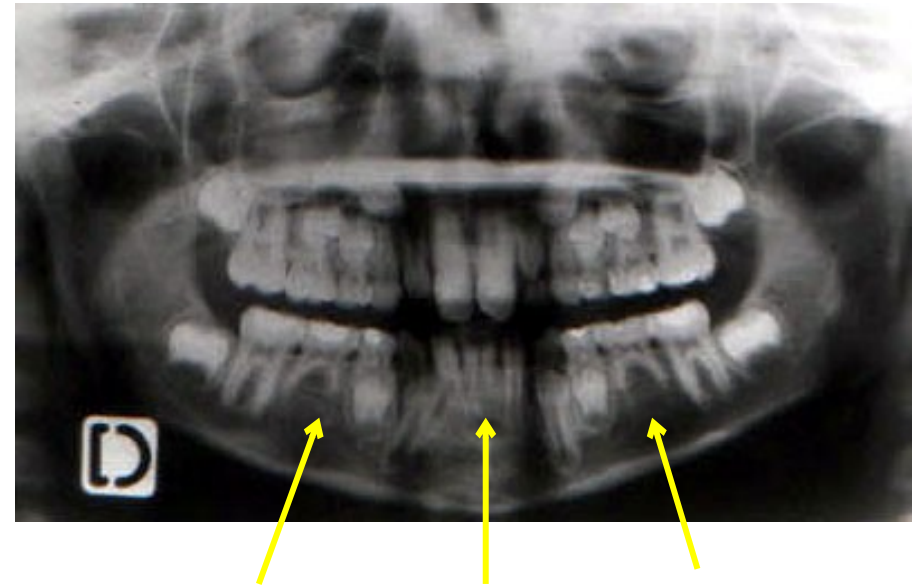
# PRESENCE OF THE PERMANENT TOOTH GERM

- No second dentition take place without a tooth germ
- Aplasia - prevalence: 3-4%.
- Gábris et al: I2<sup>></sup>pm2<sup>></sup> PM2<sup>></sup>i1
- Milk tooth persistence
- Bolk's theory of terminal reduction



# APLASIA: 35; 31; 41; 45

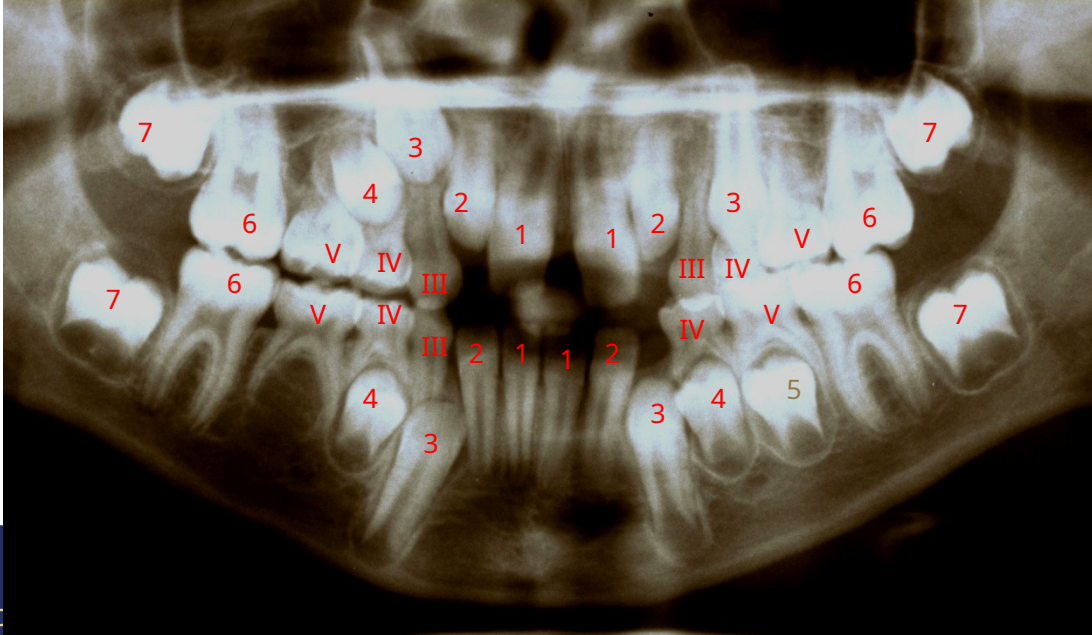
- persistent deciduous teeth: 75; 71; 72; 85
- Bolk's theory of terminal reduction - exception: mandibular central incisors



# 7 years old – Aplasia: 15; 24, 25; 45



- Bolk's theory of terminal reduction?
- Diastema medianum.
- Lateral crossbite - right.
- Open bite - frontal, vertical.
- Overjet: open sagittal.
- Tongue thrust swallow





# Optimal position of the permanent tooth germ

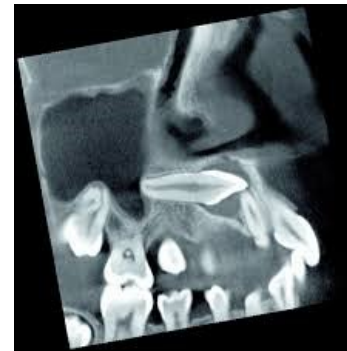
Mandible : Lingual eruption of the central incisors, the deciduous teeth are still present.

Extraction of the deciduous incisors.

Permanent teeth can erupt spontaneously

Growth of the jaw bones

Strength of the tongue muscles



Upper canines:

Ectopia.

Retention/impaction



# Optimal position of the permanent tooth germ

Premolars: impaction, torsion



Incisors: crossbite, labial/palatal position



TRANSPOSITION: 13 and 14  
RETENTION: 23; PERSISTENT: 53; 63



# SPACE CONDITIONS - LACK OF SPACE

- Supernumerary teeth, mesiodens;
- Premature primary tooth extraction;
- = if the eruption of the corresponding (following) permanent tooth does not occur in 1-1,5 years according to average eruption time;
  - ossification;
  - neighbouring tooth movement;
  - permanent tooth impaction: 2<sup>nd</sup> premolars

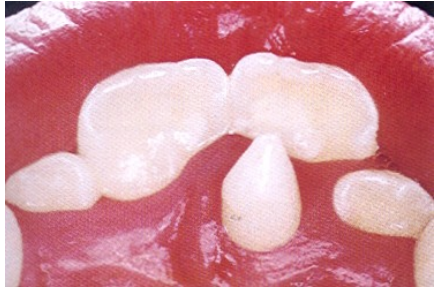


# MESIODENS

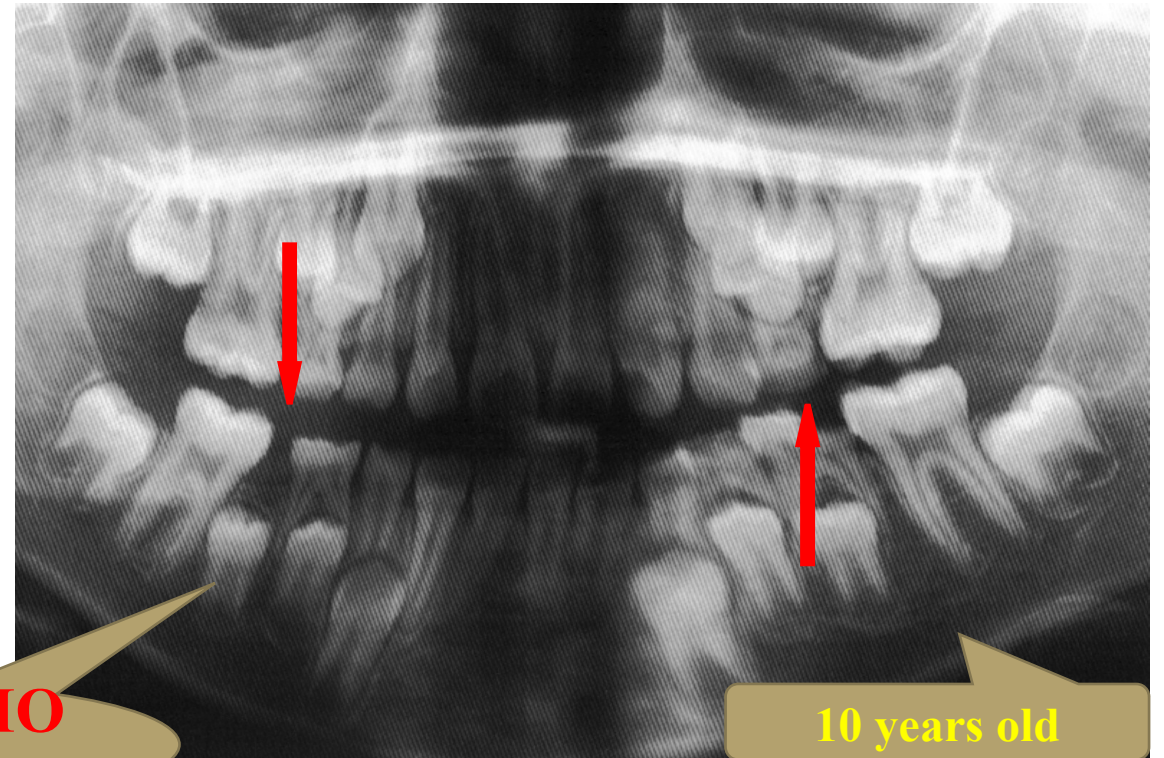
- *DENS SUPERNUMERARIUS*
- *DENS SUPPLEMENTARIUS*

# Supernumerary teeth

- *DENS SUPPLEMENTARIUS*



# Early milk tooth extraction



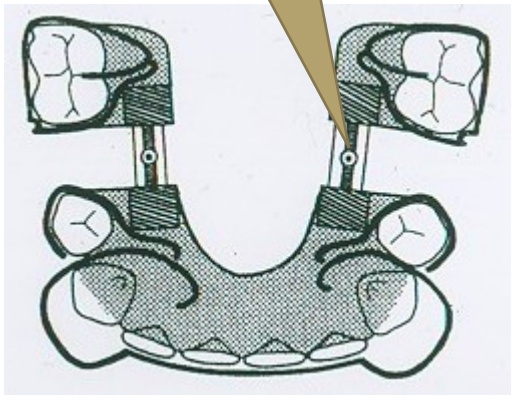
**IMPACTIO  
N**

**10 years old**

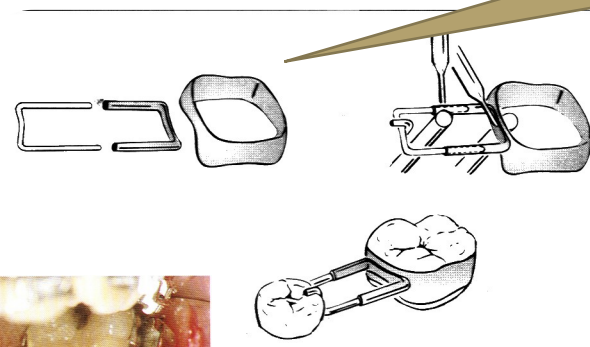


# Spacemaintainer

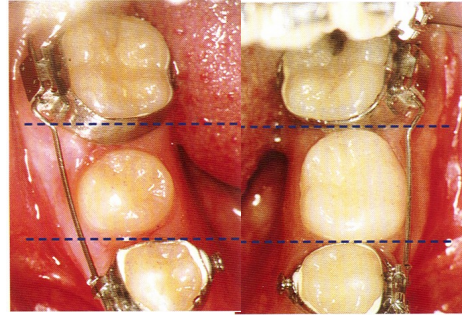
*Removable active*



*removable, passive*



*Fix, active*



*fix, passive*



# Physiological root resorption of the deciduous tooth

- Genetically fixed trait
- = a spatially and temporally defined process that presupposes the presence and optimal position of the permanent germ and the integrity of the periapical area.
  - Stratum corticale: the denser plate surrounding the dental crown, which is clearly visible on X-rays.
  - Pericoronal space: a 1 mm wide gap between the tooth crown and the stratum corticale. It remains intact during the entire tooth replacement process, the permanent tooth and the deciduous tooth do not come into contact! But it is transformed and is then referred to as the resorptive space.



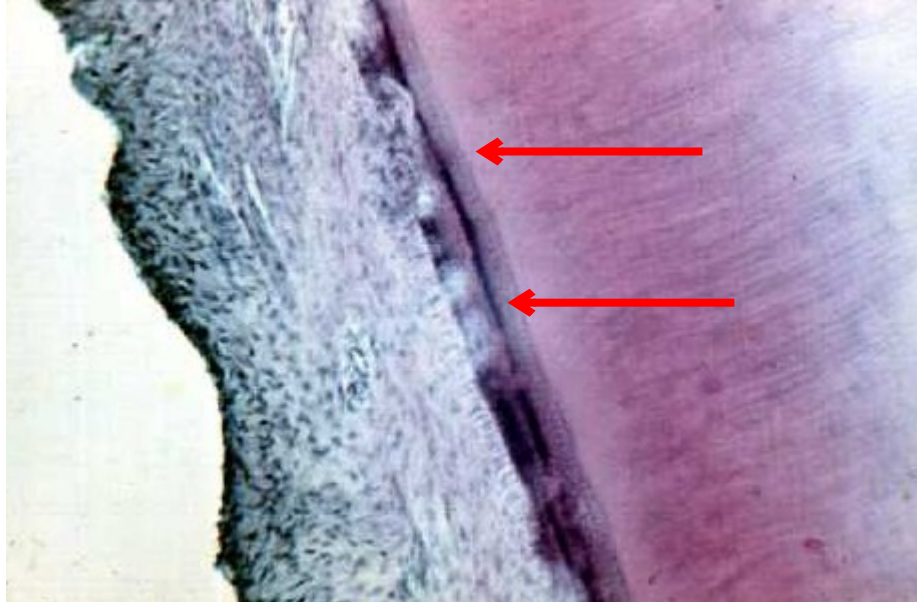


# Physiological root resorption of the deciduous tooth

- Measurable weight loss associated with the resorption of milk teeth: on average 4 mg/month
  - Eruption: first the bony plate breaks off, followed by resorption



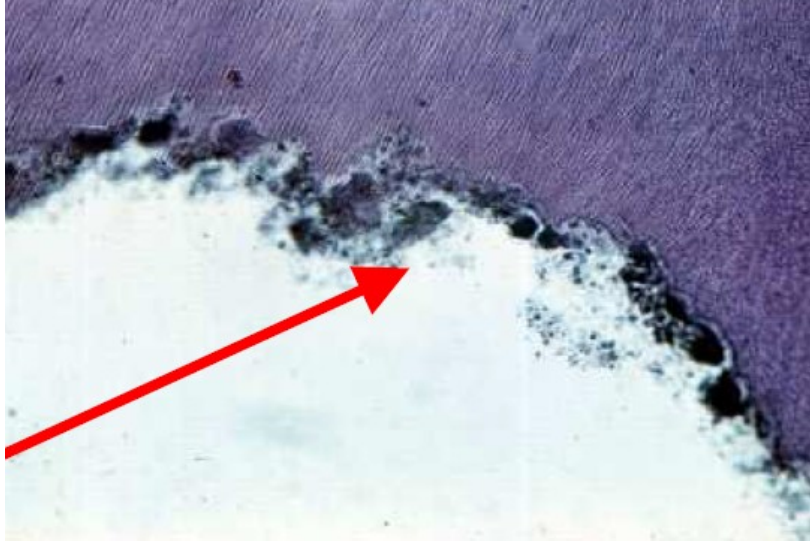
# Physiological root resorption of the deciduous tooth



- Initial stage
- Still completely intact periodontal ligaments next to nodular resorption areas in the cementum.
- The growing permanent tooth exerts pressure on the deciduous tooth.



# Physiological root resorption of the deciduous tooth



- Advanced stage.
  - Osteoclasts

- Final stage
  - The mucosal epithelium grows in under the deciduous tooth and lifts the crown (sequestrum).



# Pathological phenomena

- Time
- Space
- **THE PATHOLOGICAL TRIAS:**
  - Perturbance of the primary root resorption;
  - Persisting primary teeth;
  - Retained permanent teeth.



# Time differences

- DENTITIO PRAECOX
  - DENTITIO TARDA
  - DENTITIO DIFFICILIS
- 
- The process of second dentition differs from the average
    - acceleration

# DENTITIO TARDA

- Scar remains (mucosa): trauma, surgical procedure
- Gingival fibromatosis/hyperplasia
- Tumour: odontogenic/non-odontogenic
- Accident of a milk tooth
- Ankylosis of deciduous teeth
- Prematur extraction/exfoliation of deciduous teeth
- No physiological milk tooth root resorption
- Odontodysplasia
- Impacted milk/permanent tooth
- Skeletal anomalies
- Cleft lip and palate
- radiation damage



# SPATIAL VARIATIONS

- changes in the resorptive spacing
- The periapical space widens to an extreme extent due to infections, the cortical space disappears
- Resorption: irregularly shaped protrusions at the roots of the deciduous tooth
- Residual germ aplasia: ~ 70% of persistent deciduous teeth show resorption
- Infraocclusio secundaria: ~ 40% of persistent deciduous teeth

# INFRAOCCLUSION SECUNDARIA

Names.

Partial retentio; reinclusio

Submergentia

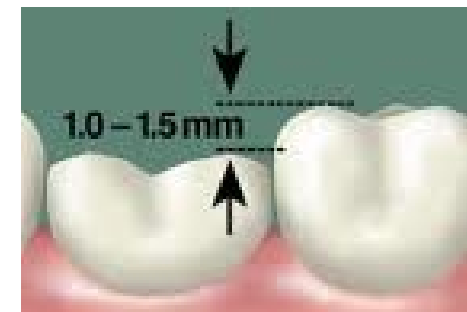
"Halbretention"

"submerged deciduous teeth"

Pathomechanism: controversial

processus alveolaris is retarded in development

persistent milk law does not follow physiological increase in bite height





# Eruption

Gingivitis eruptiva



Eruption cyst

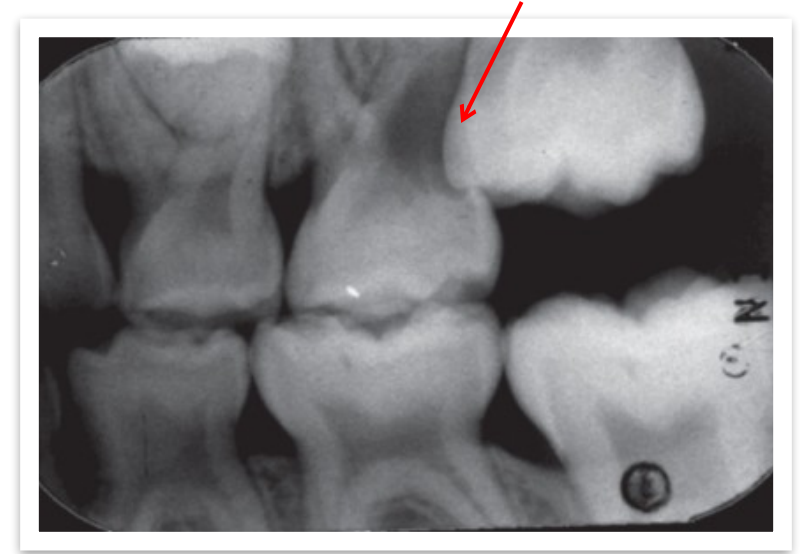
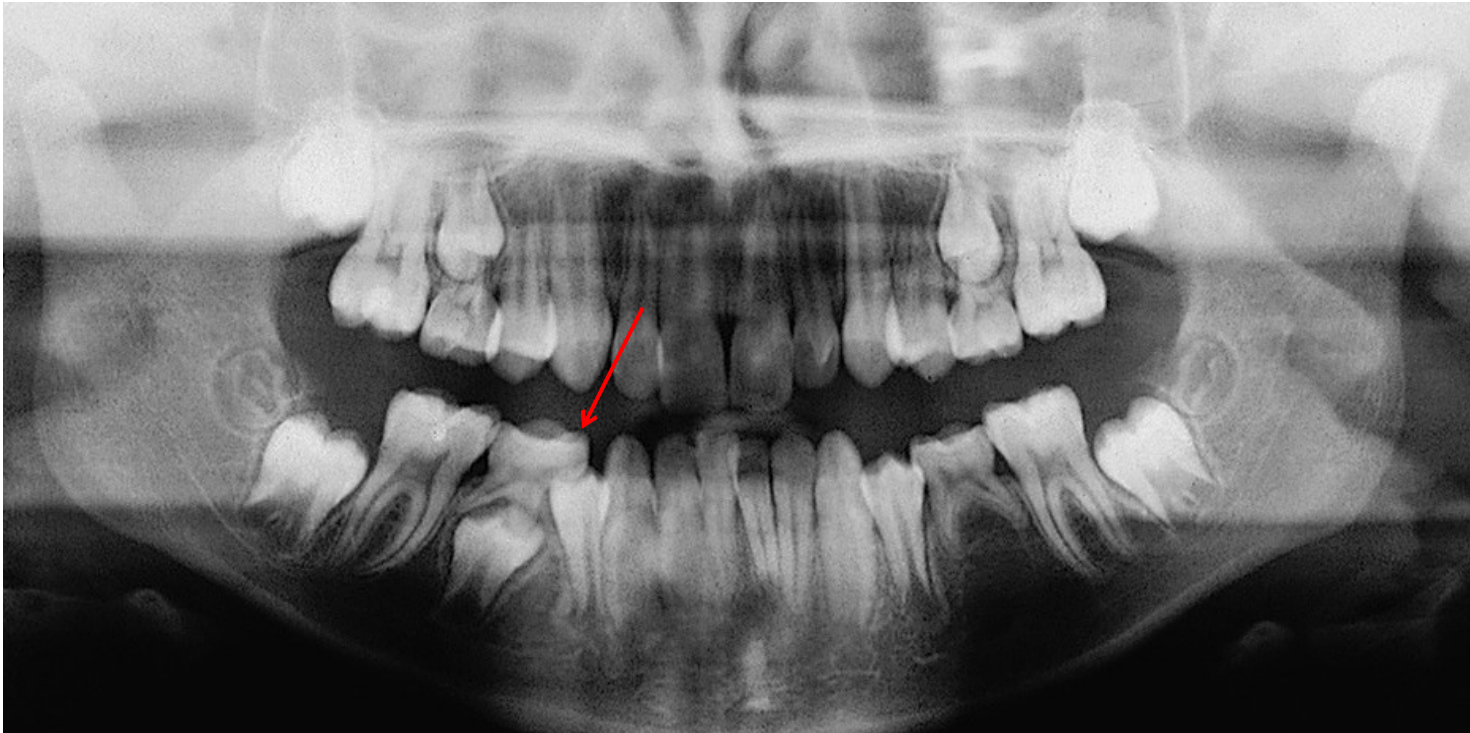


Eruption cyst  
11, 21



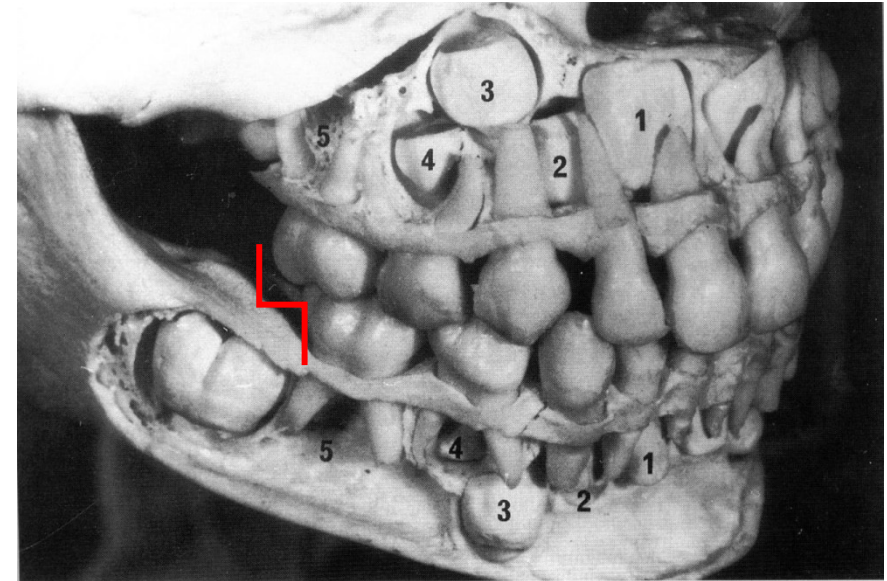
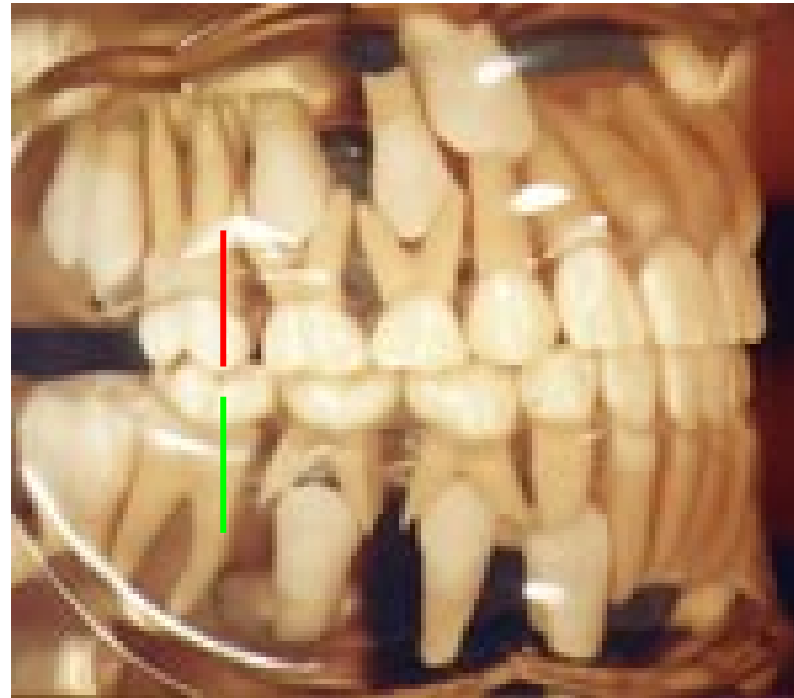
Eruption cyst  
16

# The undermining resorption



# Eruption and occlusion

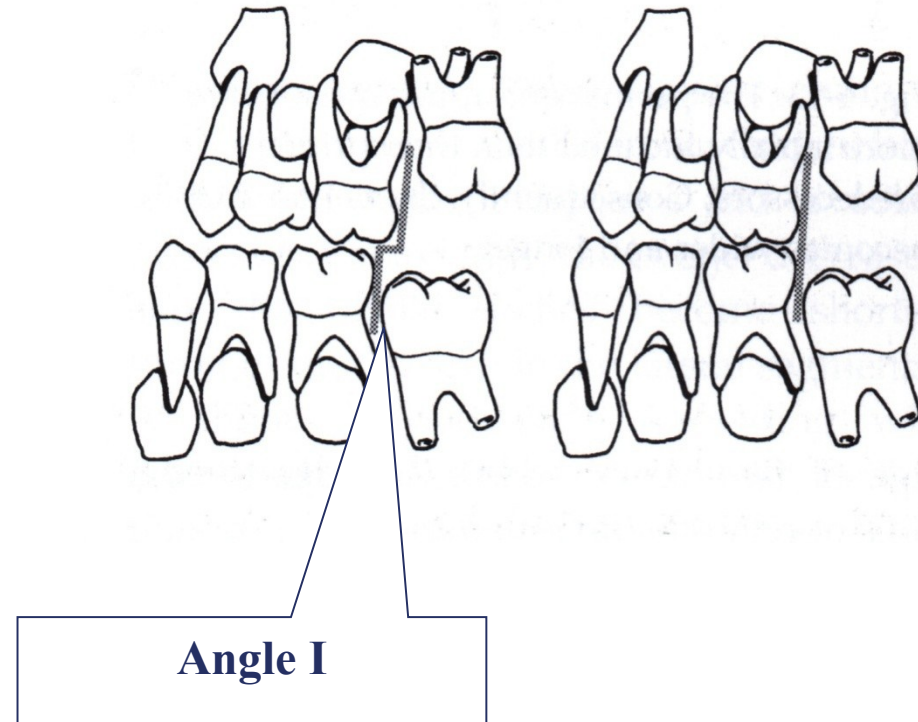
- The relationship between the root of the deciduous tooth and the crown of the developing permanent tooth at the time of deciduous dentition





# Occlusal relationships of the deciduous molars Connection with the formation of a neutro-occlusion in the permanent dentition- **distal terminal plane** **„postlacteon” – postlactealis plane**

If there is a mesial step behind the second deciduous molar at the time of deciduous dentition: the occlusion ratio of the first permanent molar may be optimal

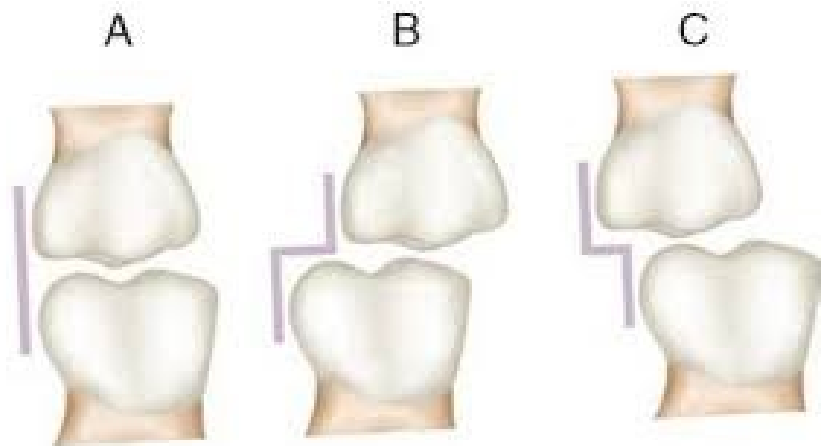


If the dental arches end in the same vertical plane at the time of deciduous dentition: the 6s meet in the Angle II relation

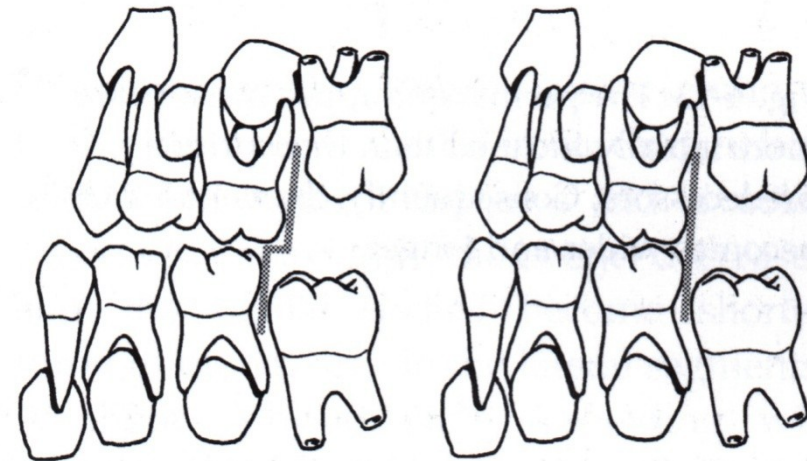


# Occlusal relationships of the deciduous molars Connection with the formation of a neutro-occlusion in the permanent dentition- **distal terminal plane** **„postlacteon” – postlactealis plane**

„Postlakteon“

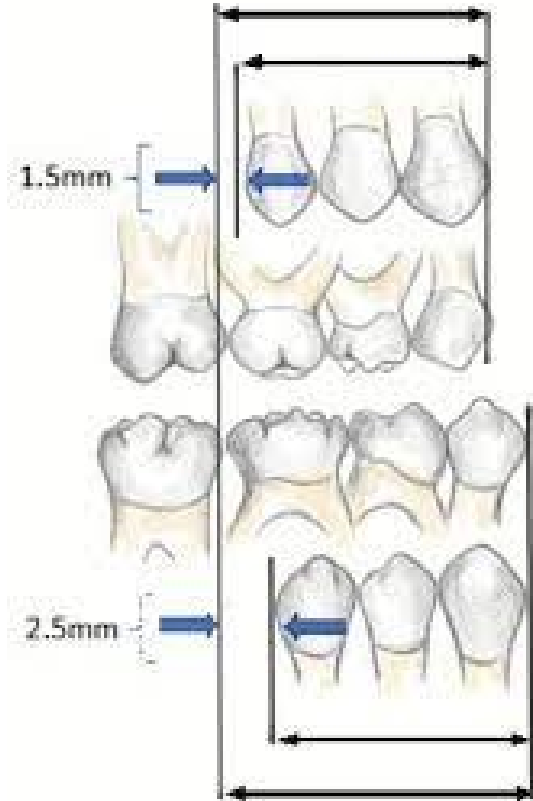


- singular antagonism
- alternating interlocking



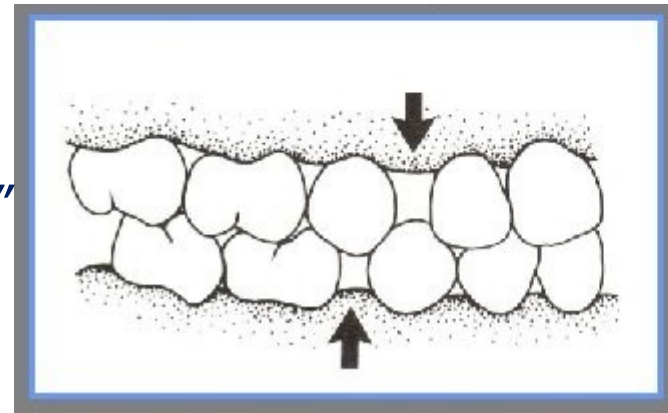
**Angle I**

# LEEWAY SPACE



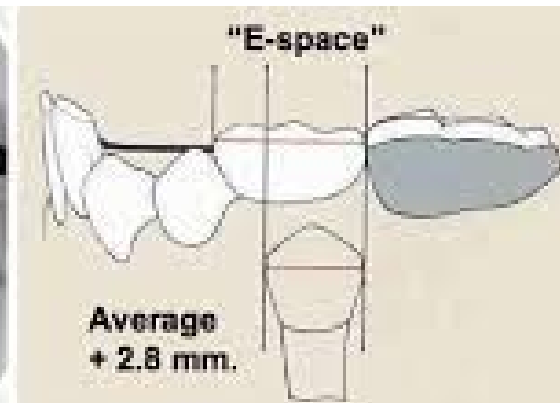
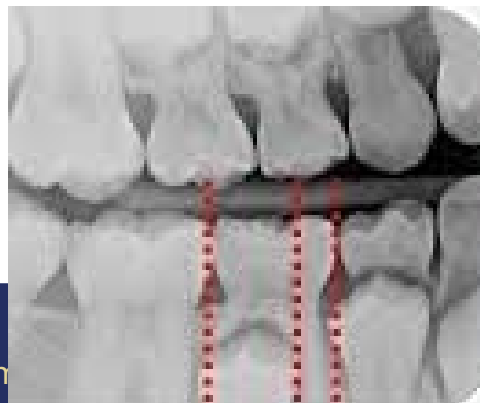
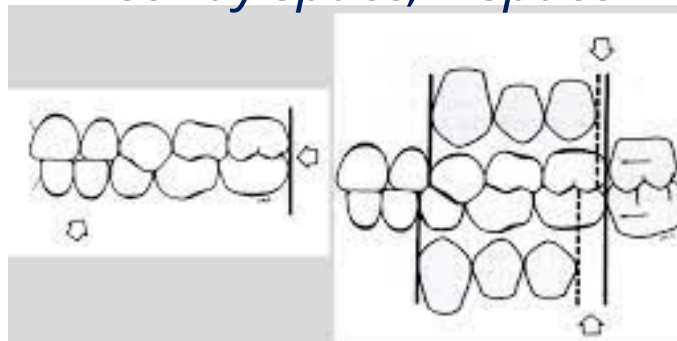
# PRIMATENLÜCKEN

„the early mesial shift”



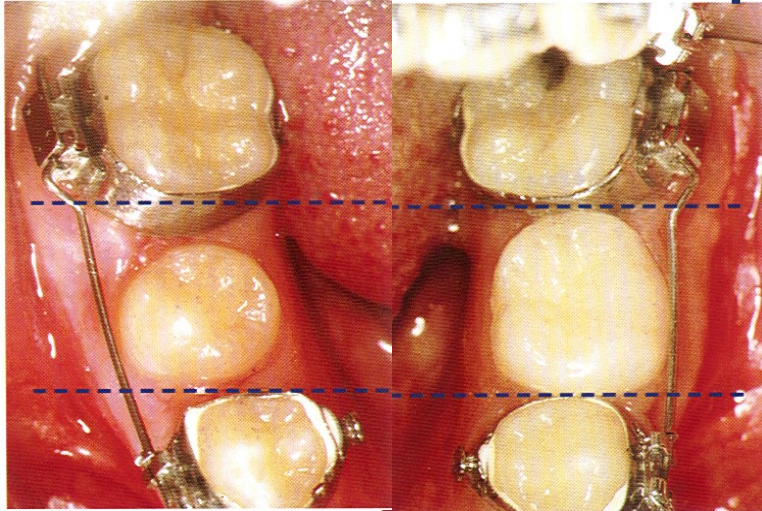
➤ *Postlactealebene – distal terminal plane*

„the late mesial shift”:  
*Leeway space, E-space*



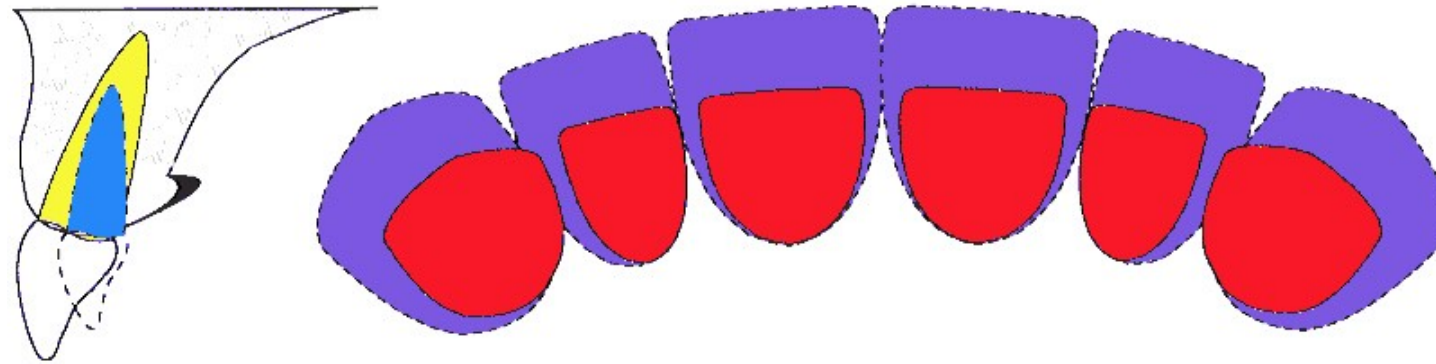
# Placeholder/ Spacemaintainer

Leeway-  
space



*Képek forrása: Ch. Splieth: Kinderzahnheilkunde in der Praxis, Quintessence Verlag, 2002.*

# Changes in the front region



- Upper permanent incisors inclined more labially than the milk incisors
- The dental arch becomes wider and longer

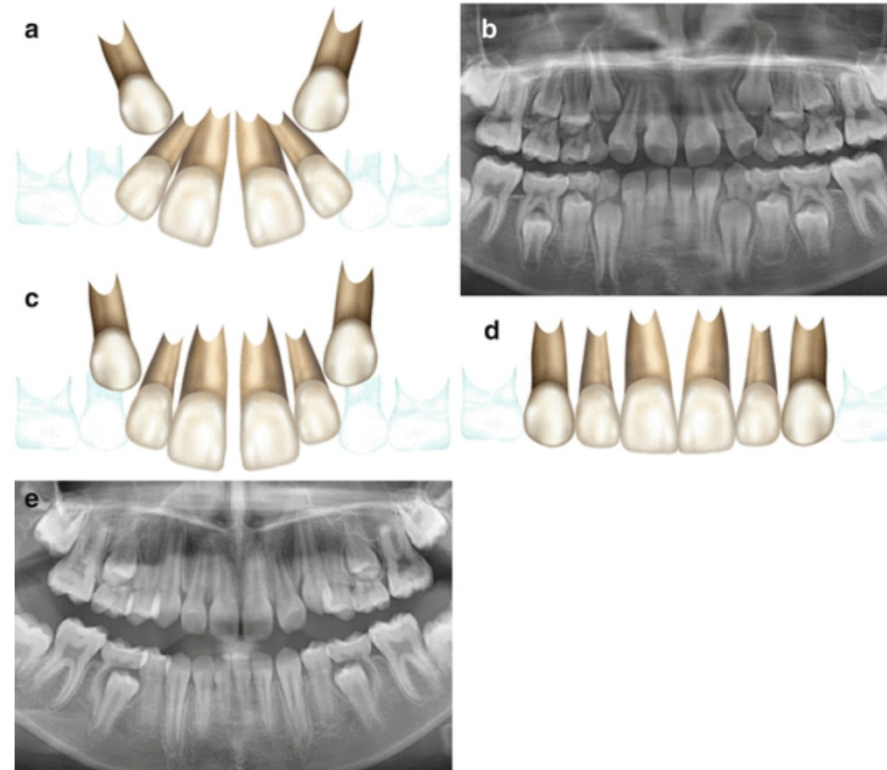
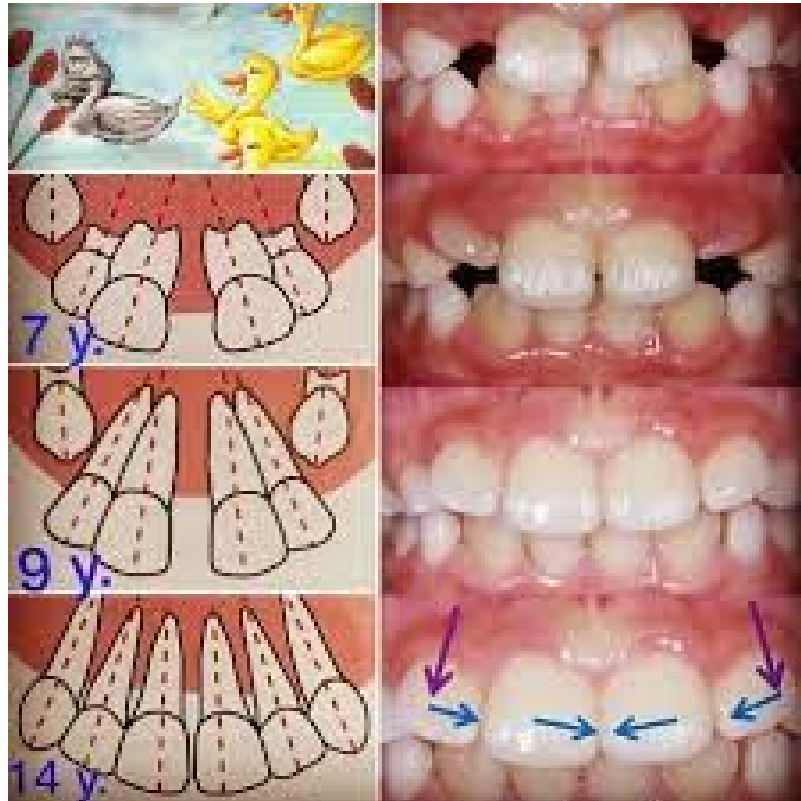


**UGLY  
DUCKLING  
STAGE**



Ugly? Me? Well,  
they need glasses!

Dr. Jula





# Thank you for your attention!

Dr. Macsali Réka



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**SEMMEWEIS**  
EGYETEM 1769

Semmelweis University  
Department of Paediatric Dentistry and Orthodontics

Dr. Macsali Réka