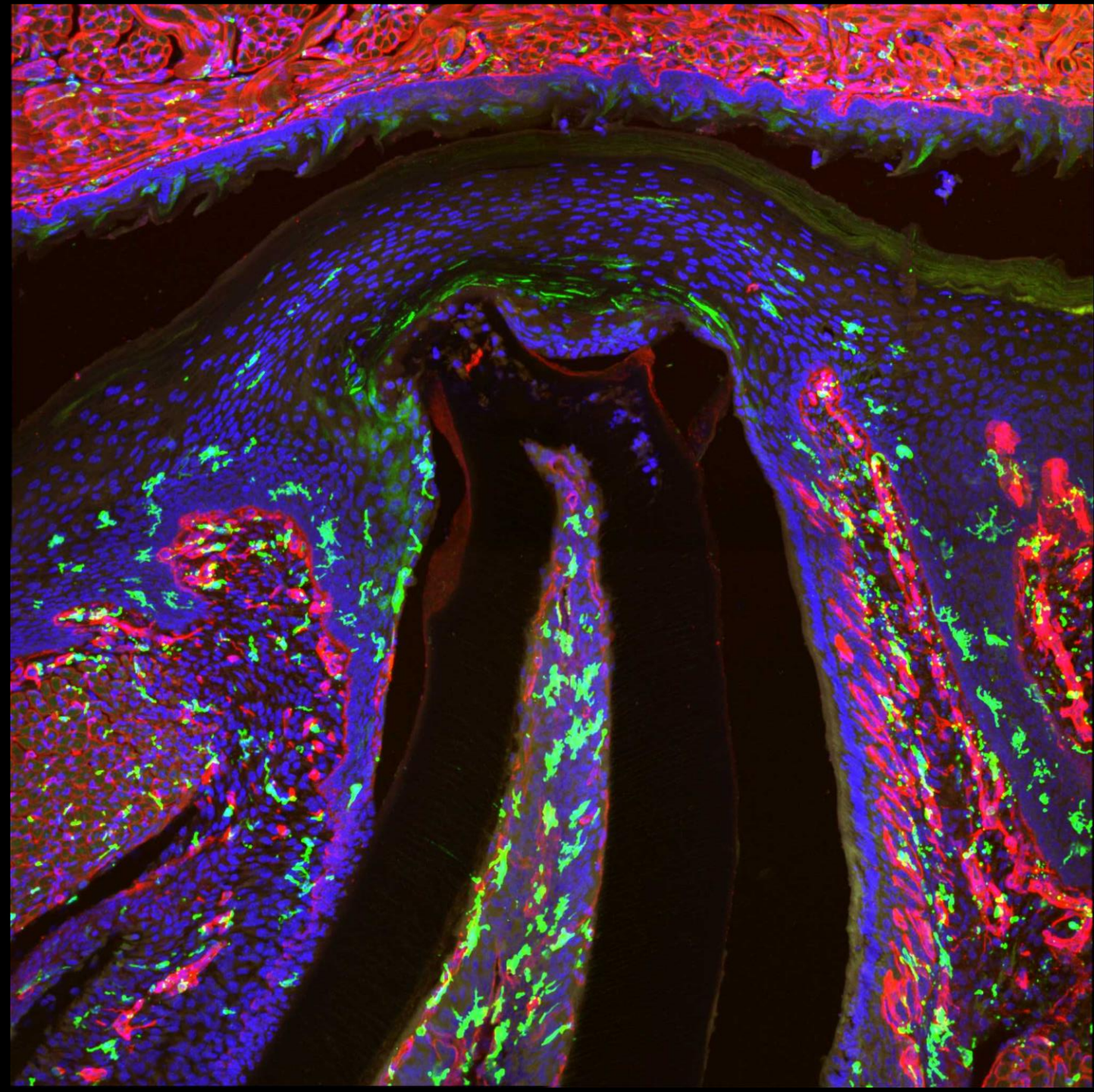


# Permanent dentition, Development, Defects

19. 5. 2022

# Eruption



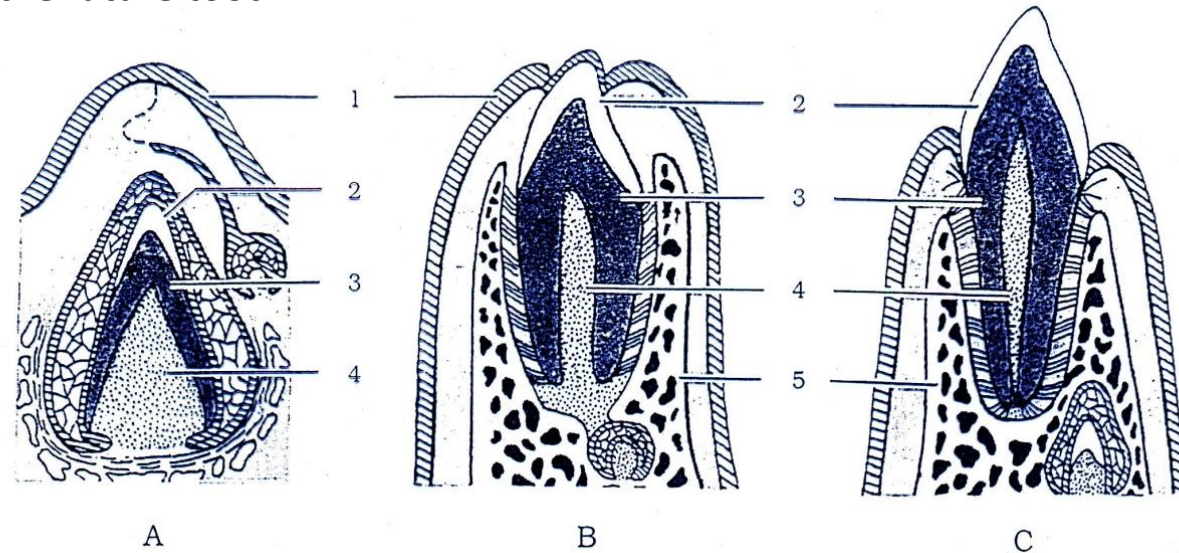
# Eruption

## **Tooth eruption = growth process**

It is manifested by the fact that the dental crowns protrude from the gingiva at a certain time, reach the oral cavity and eventually the occlusion plane.

Primary dentition: **5. - 30. month after born**

## **Growth and elongation of the root of the future tooth**



## **Progress:**

The root of the tooth grows to the bottom of the ossified alveolar bone

During further growth it rises and pushes the dental crown to the surface of the gum wall

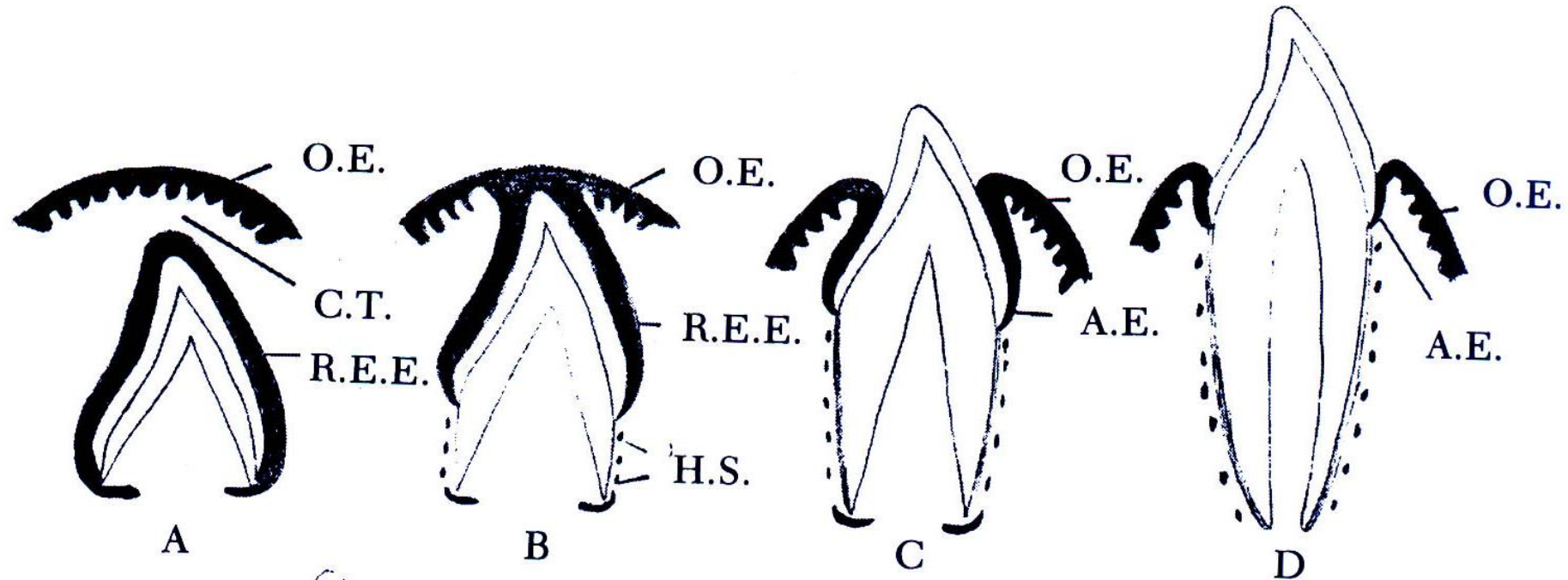
Gingival compression - vascular supply disorder and necrosis in the terminal phase

After the dead tissue is removed, a dental crown hole is created



# Eruption

During eruption, the crown is protected by the enamel residue: **reduced enamel epithelium (REE)**

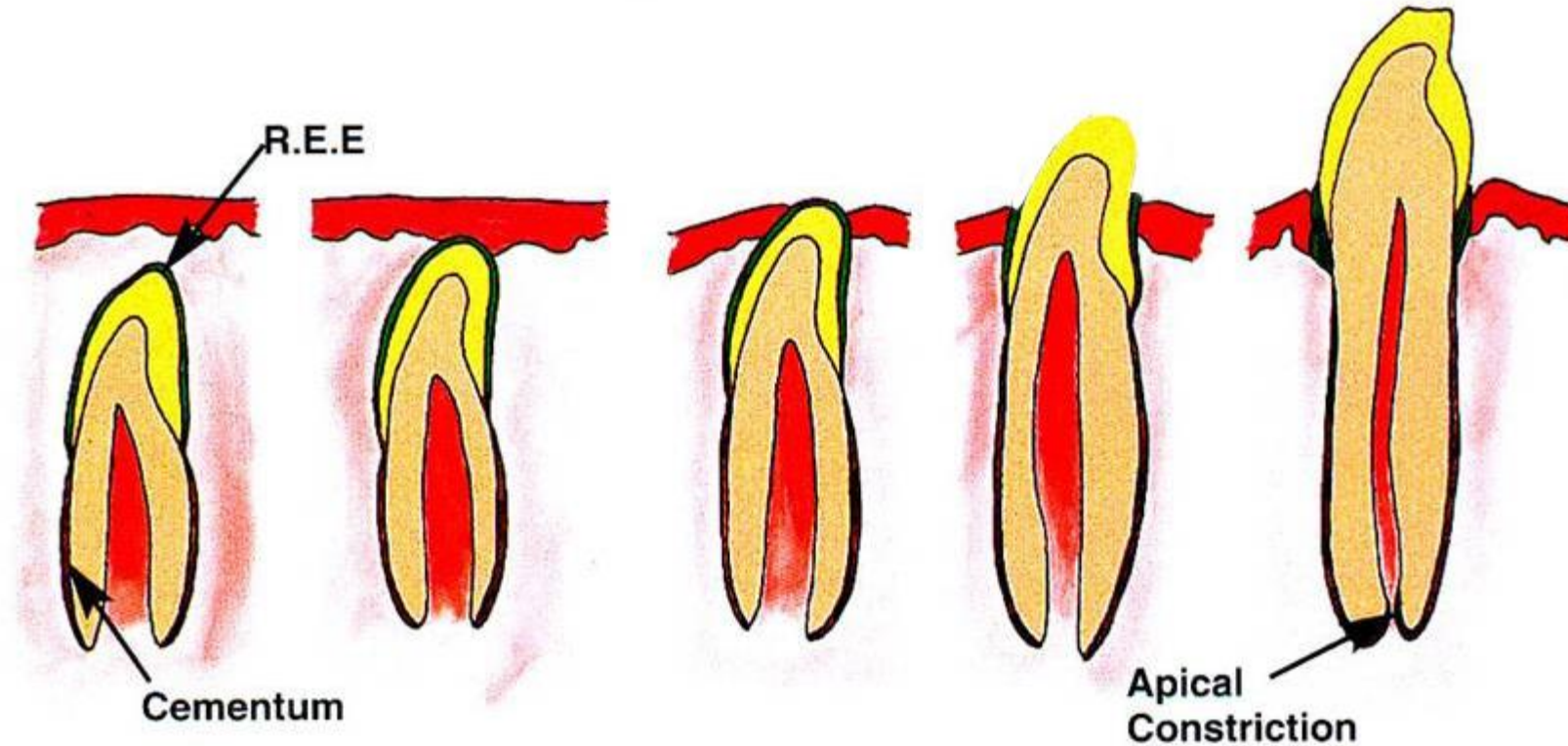


When the crown reaches the gum wall, **the reduced enamel epithelium fuses with the oral epithelium**

During the crown eruption, the reduced enamel epithelium gradually separates from the enamel surface

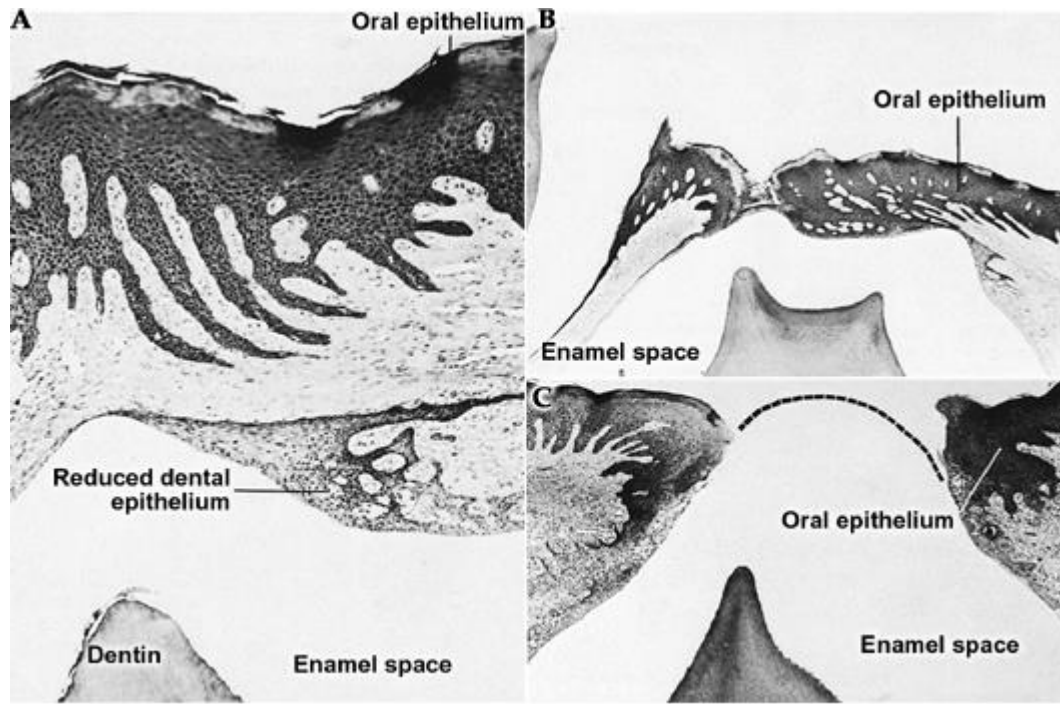
# Eruption

When the tooth crown reaches the occlusion plane, there is a 1-2 mm wide strip around the cervical part of the crown – **dento-gingival epithelium**

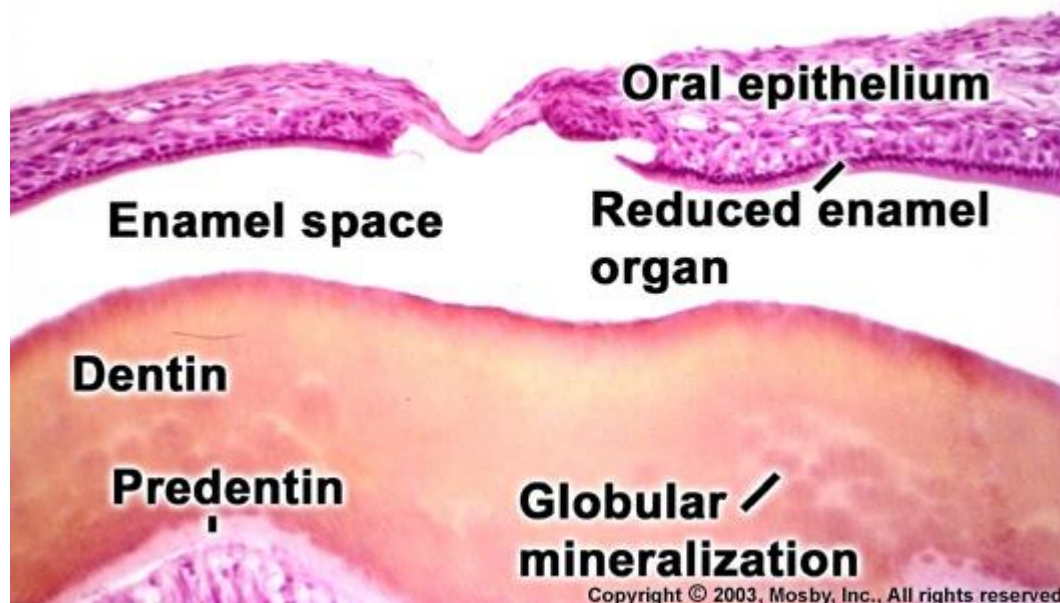


**Fig. 26.6** Diagrammatic representation of the development of the dentogingival junction during the eruption of a tooth. R.E.E. = Reduced enamel epithelium (green). Red outline delineates oral epithelium.





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# Alveolar process development

It is established together with the other parts of the upper and lower jaw. **Intramembranous ossification**

**Initially, it is low and develops with the development of tooth roots and during eruption of the dentition.**

It is distinguished into

- a) Cortical bone (*lamina vestibularis, lamina oralis*)
- b) Proper alveolar bone (*os alveolare*)
- c) Supporting bone (*spongiosa*)

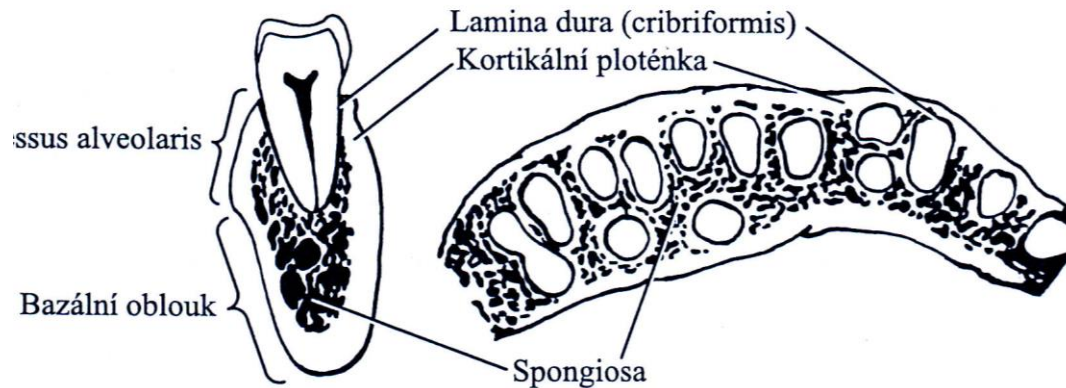
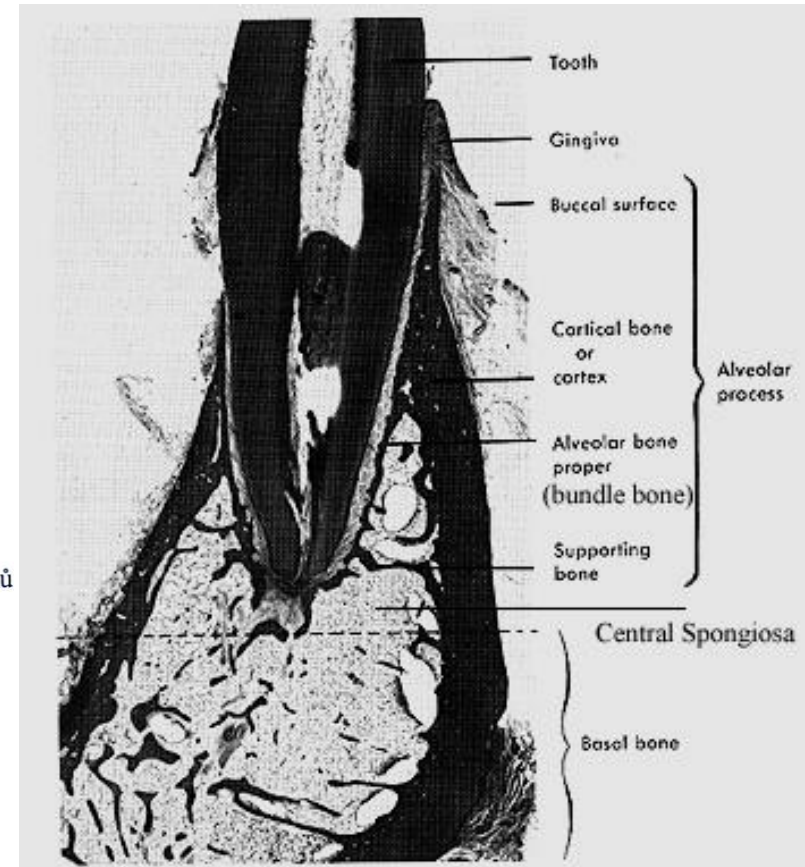


Fig. 25-5. Podélný a příčný (horizontální) řez mandibulou demonstruje stavbu alveolárních výběžků a alveolární kosti.



# Timeline of primary dentition eruption

		Exfoliation (shedding)
<b>i1</b>	6. - 8. months	7 year
<b>i2</b>	7. - 12. months	8 year
<b>c</b>	15. - 20. months	12 year
<b>m1</b>	12. - 16. months	10 year
<b>m2</b>	20. - 30. months	11-12 year

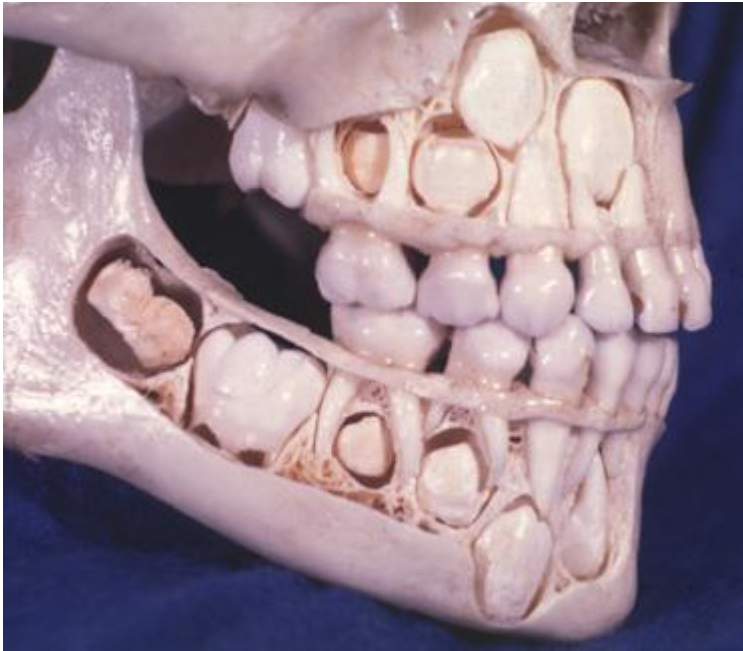
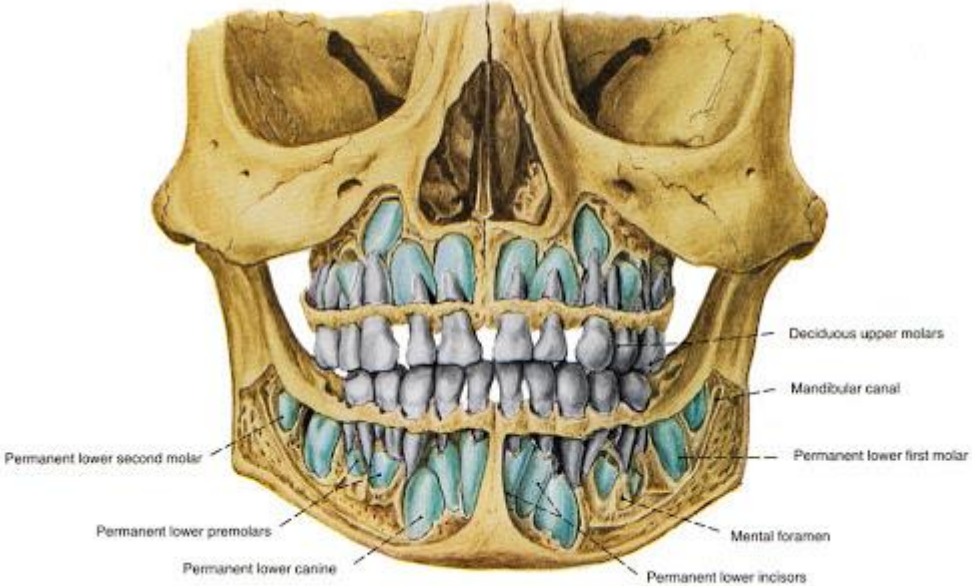
Temporary dentition erupts between 5 - 30 months after birth

Temporary dentition is fully functional until 6. year, then is being changed with secondary dentition

Exfoliation of temporary dentition follows the eruption of secondary dentition



# Permanent dentition development





# Permanent dentition development

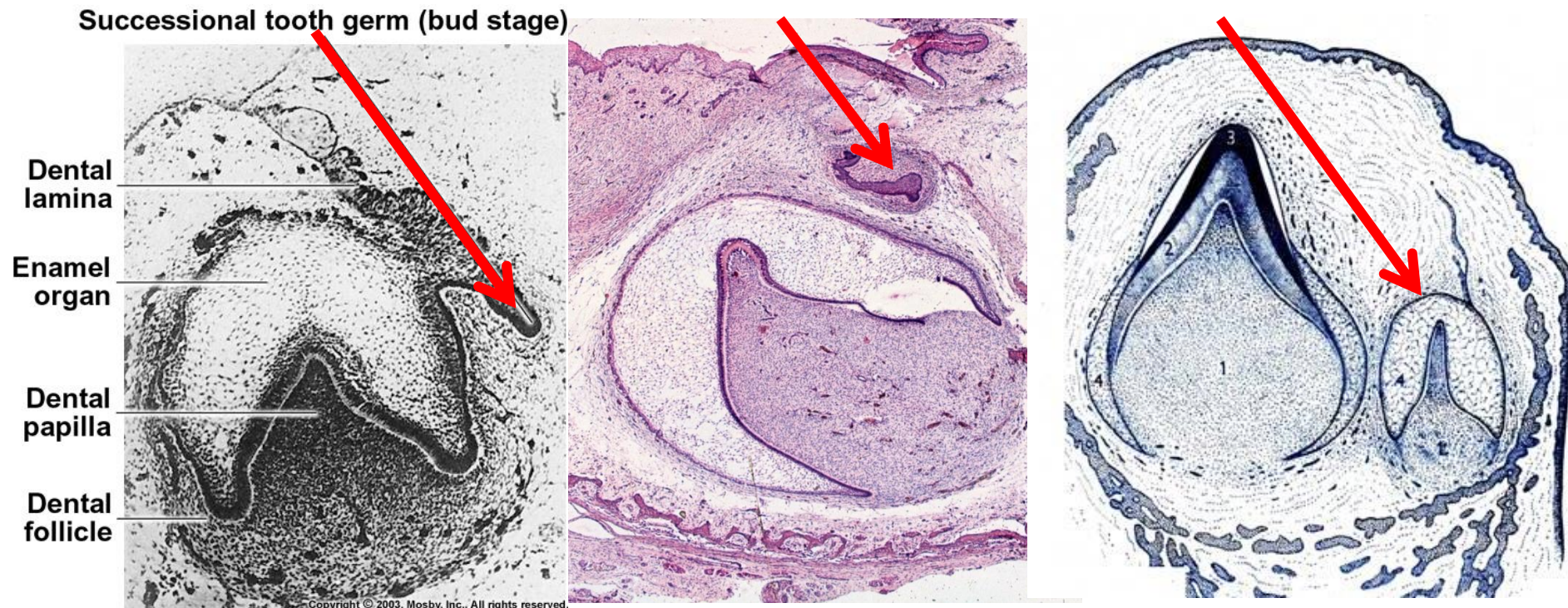
Takes a substantially longer period than primary dentition

Starts in the **middle of the 2nd trimester** (approx. 4 months of prenatal development) and ends with eruption between 7. - 17. (40). year of age

Mechanisms and developmental **stages similar to temporary dentition**

$I_1, I_2, C, P_1, P_2$ , develop from a successional dental lamina

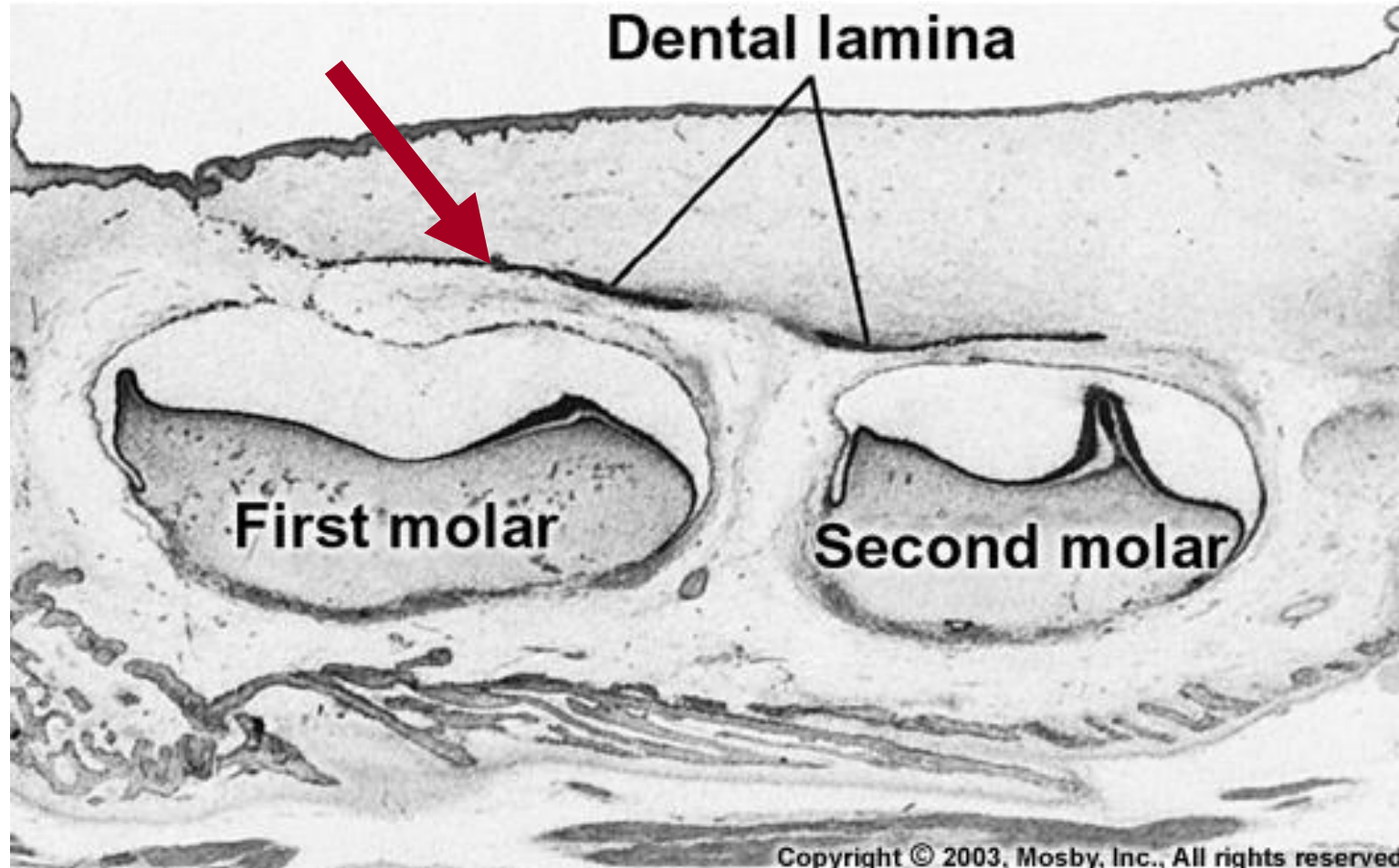
Successional dental lamina is a derivative of primary dental lamina and is segmented (in contrast to primary dental lamina)



# Permanent dentition development

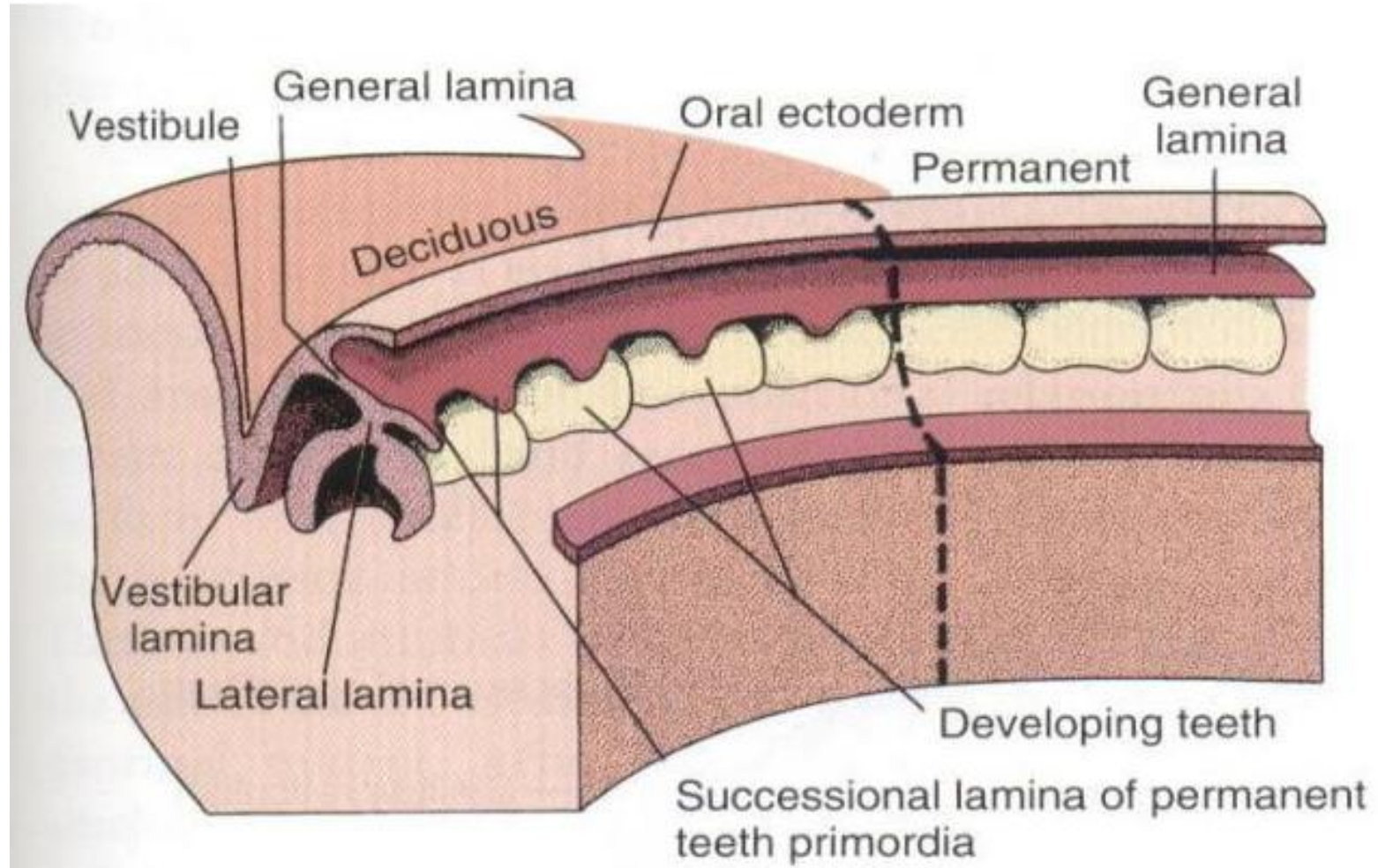
M1, M2, M3 develop from the elongation of the primary dental lamina

Developmentally molars from the secondary dentition belong to the teeth of temporary dentition





# Permanent dentition development



# Timeline of primordia of permanent dentition formation

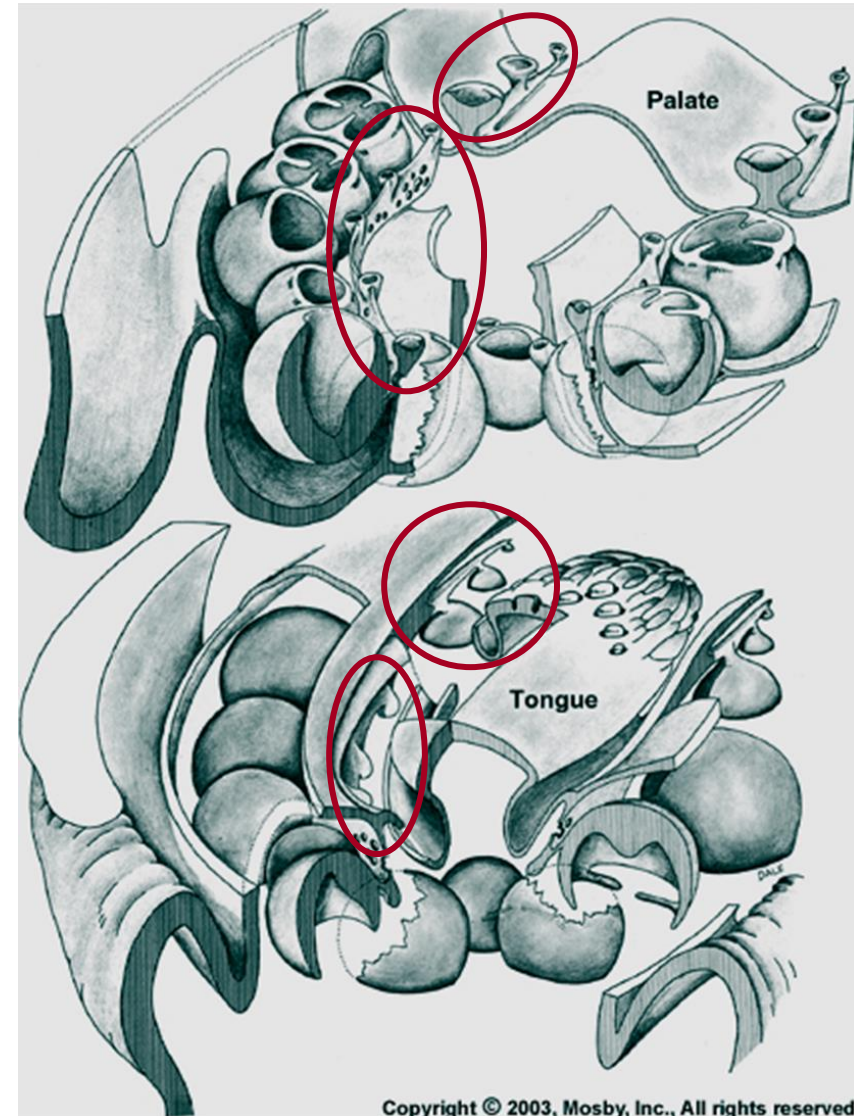
Prenatally:

M <sub>1</sub>	4. month – <i>primary lamina</i>
I <sub>1</sub> , I <sub>2</sub>	5 - 6. month
C	8. month

Postnatally:

M <sub>2</sub>	6. month – <i>primary lamina</i>
P <sub>1</sub>	10. - 12. month
P <sub>2</sub>	18. month (1,5 year)
M <sub>3</sub>	5. year – <i>primary lamina</i>

Permanent molars developmentally belong to teeth of temporary dentition



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foetus - 6 month old

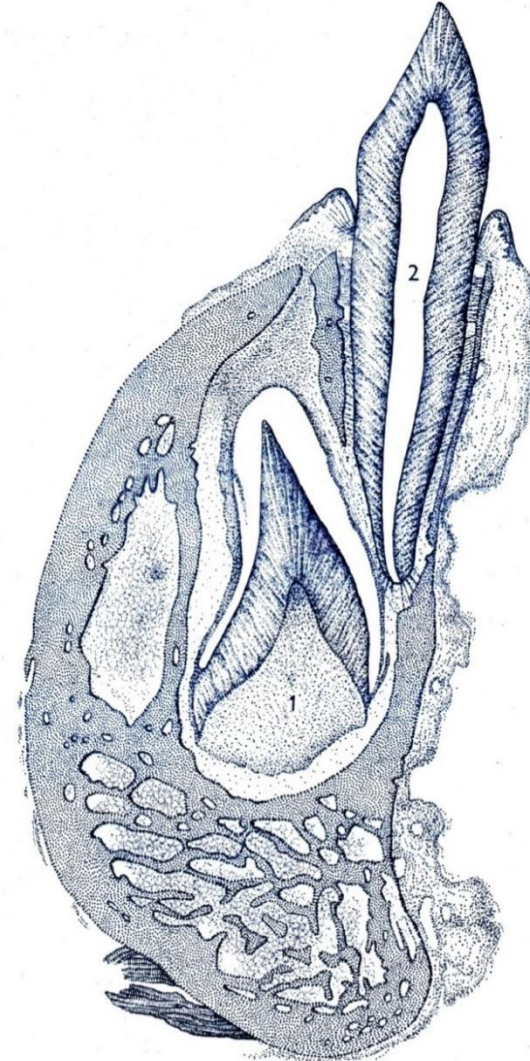
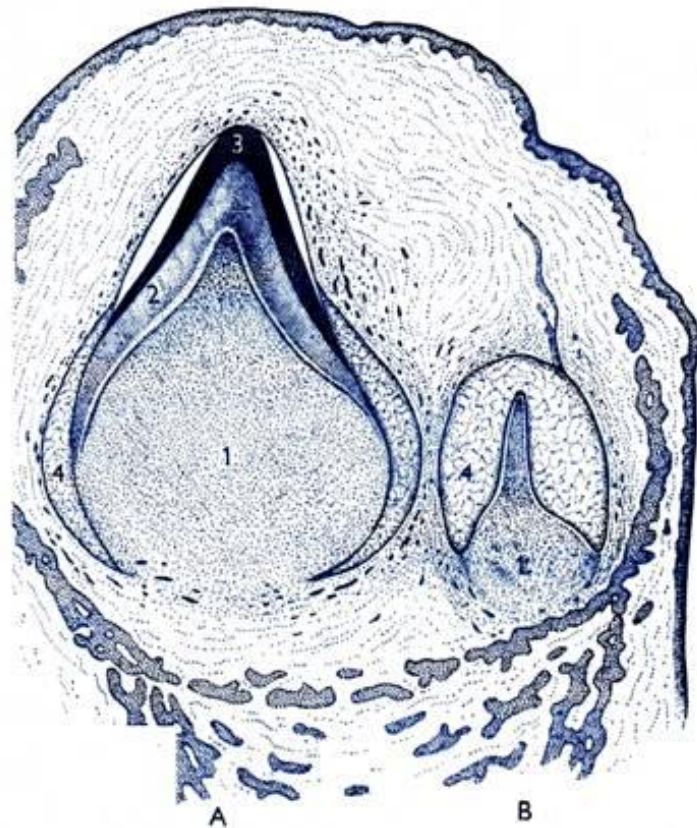


# Permanent dentition development

The follicle of temporary and definitive tooth is initially at the same level, both surrounded by ectomezenchyme and sharing part of the dental follicle

During development, the primary tooth grows and secondary takes place under the root of the temporary tooth

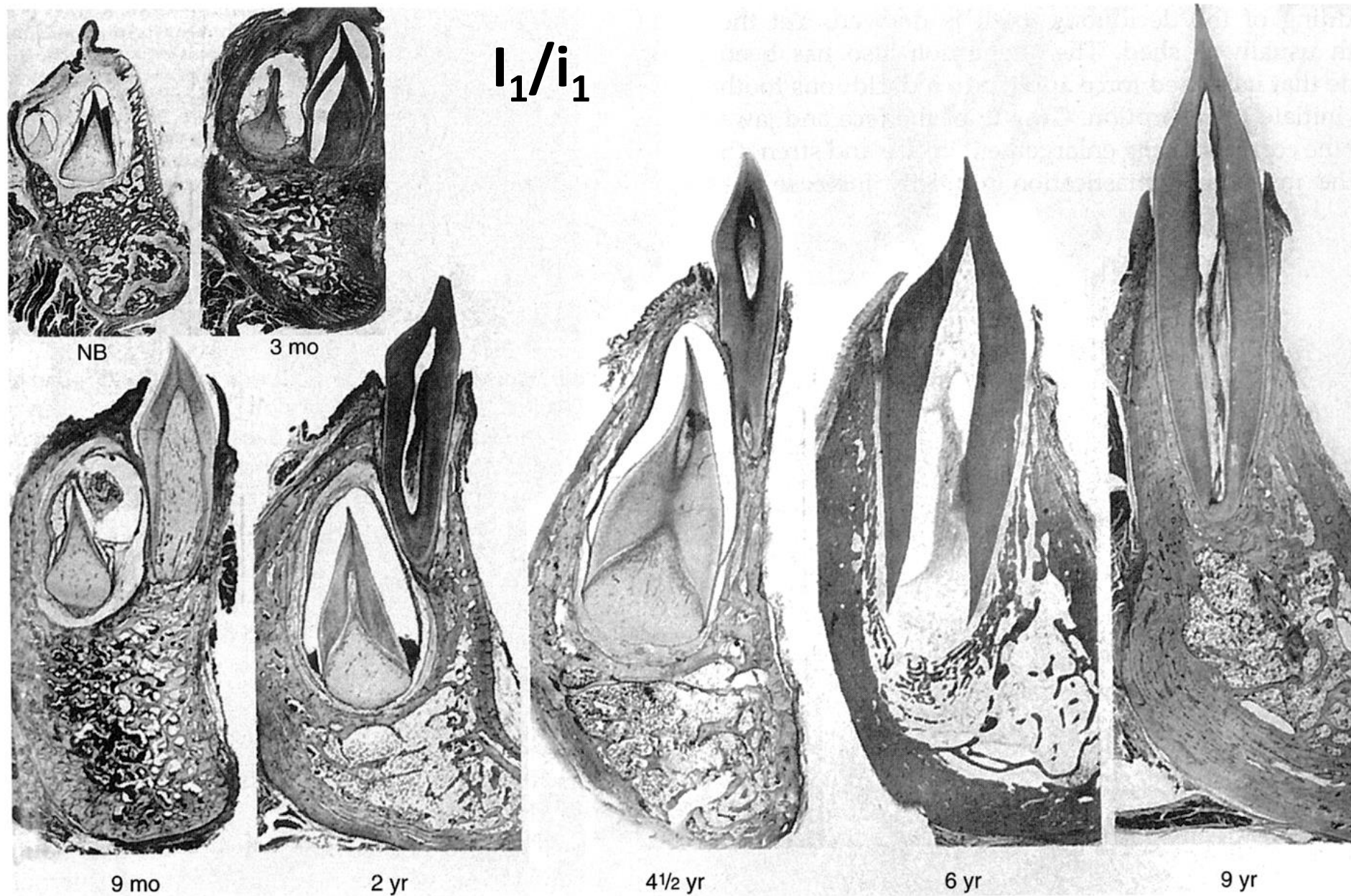
The follicles of both teeth separates the bony barrier



Obr. 83.  
Věsná subu. Dočasný zub ve stadiu spozice (A), žvané stadium



# Bucolingual crosssections through incisors (newborn - 9 years)



# Eruption of permanent teeth

Eruption of permanent molars are similar to temporary teeth

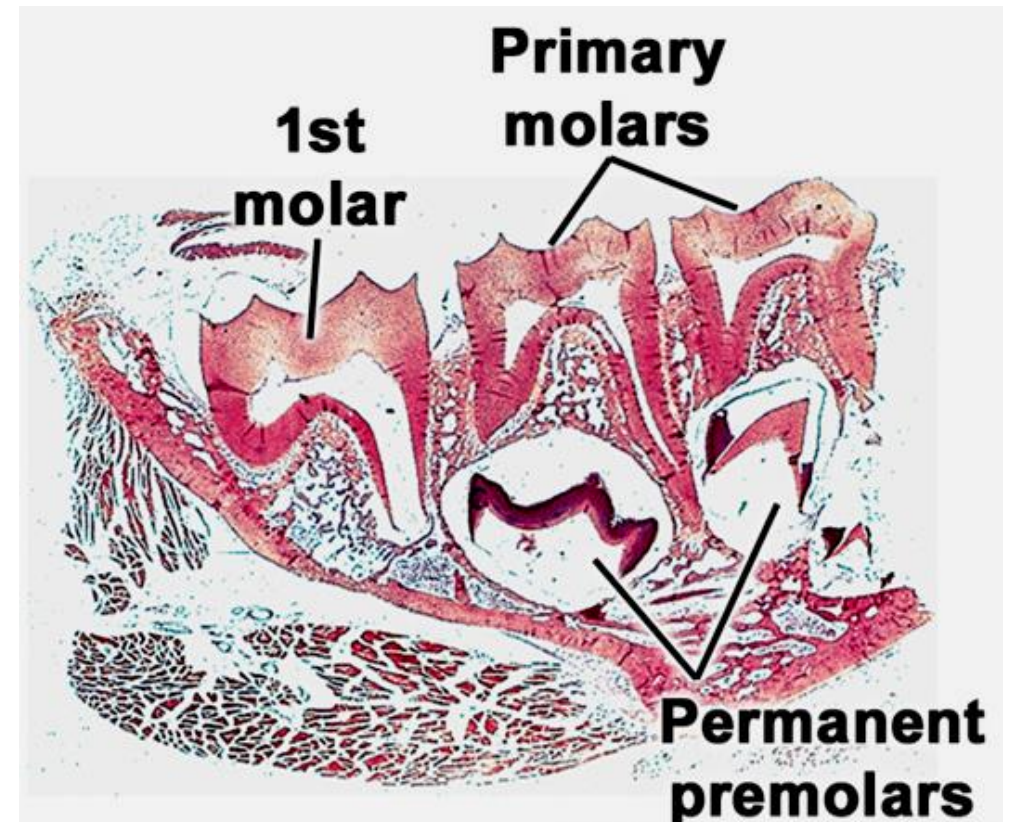
For permanent incisors, canines and premolars primary dentition needs to be removed

With the growth of the permanent root, the crown pushes the bone barrier, which separates both teeth. After resorption of the bone, the crown cause pressure on root of primary dentition which initiate radix resorption

Role of „-clasts“

The result is a gradual shortening root of a temporary tooth

In parallel there are changes in dental pulp, periodontium and epithelial tissue





# Eruption of permanent teeth

## Periodontium loses its ligamentous character

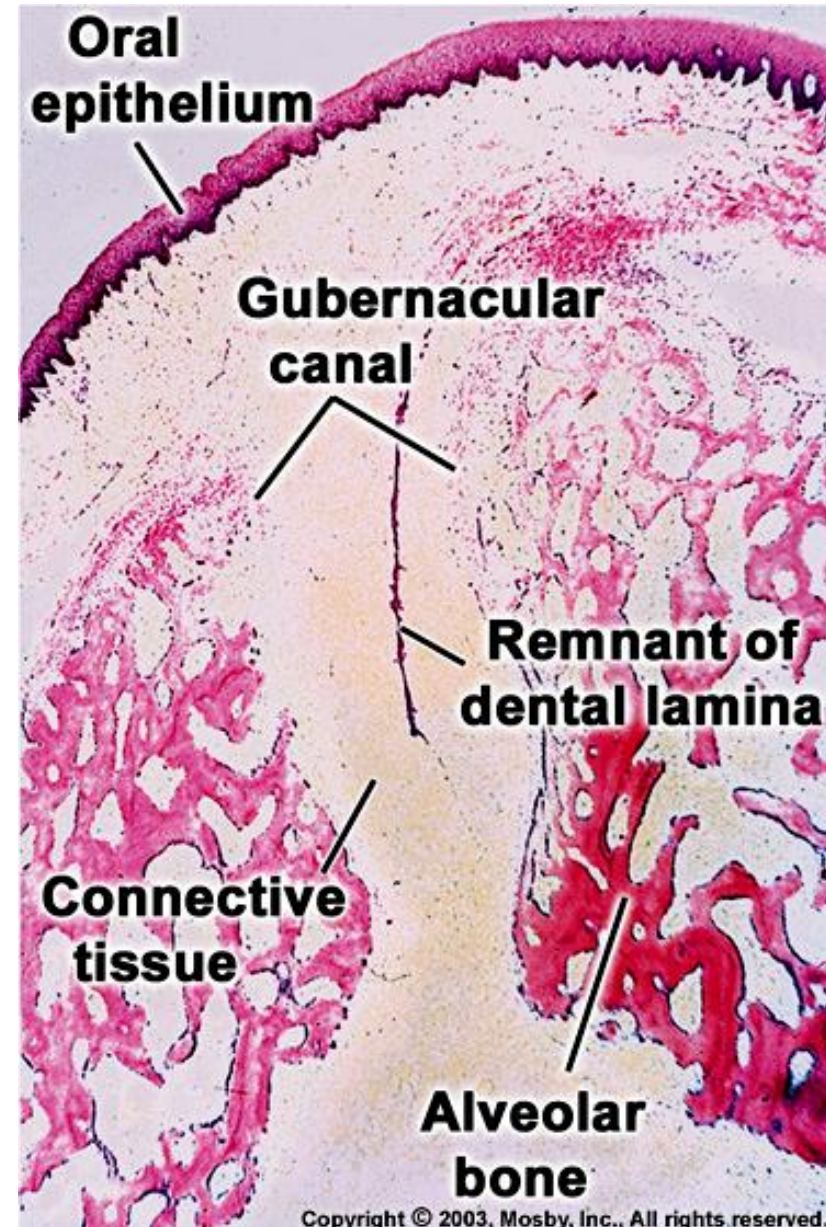
conversion into loose collagenous connective tissue (it still retains the ability of redifferentiation because it provides material for the definitive periodontium)

**Epithelial junction** is disintegrated and cementum is exposed.

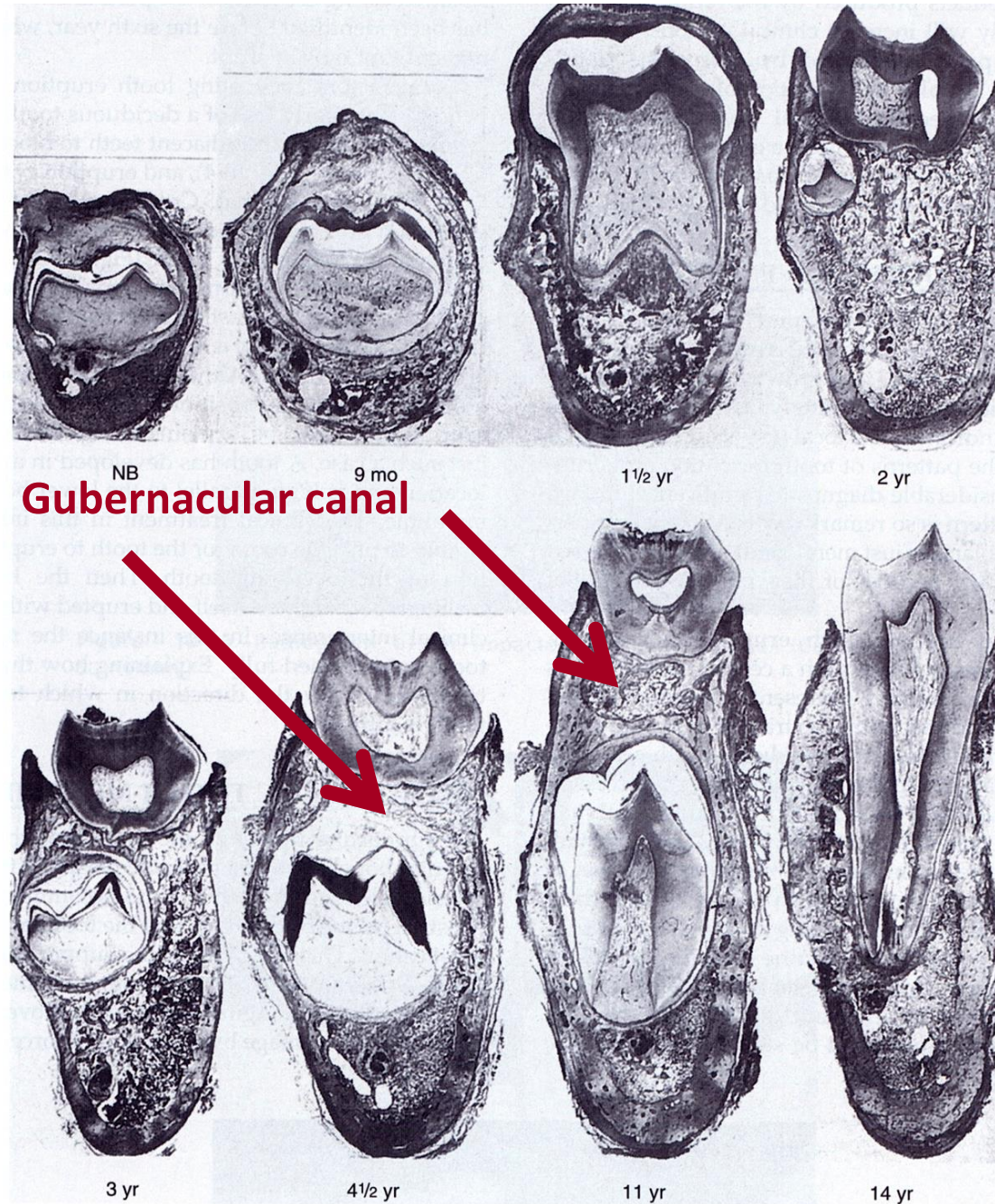
**Dental pulp** - transformation into stripes of dense connective tissue

... In case of increased load, when the ligaments are no longer sufficient to fix and stabilize the tooth when biting and chewing, the stripes break and the temporary tooth falls out (exfoliation)

The channel formed after the temporary tooth has fallen out (called **gubernacular**), will be used by a permanent crown for easier eruption into the oral cavity







**Figure 10-22—cont'd B,** Buccolingual sections through the deciduous first molar and permanent first premolar of the mandible at representative stages of develop-

## Časový průběh vývoje trvalé dentice:

ZUB	ČELIST	Zubní pohárek	Začátek kalcifikace	Dokončení vývoje skloviny	Prořezání	Dokončení vývoje kořene
<b>I 1</b>	mandibula	5 - 6 m. pre	3 m.	5 r.	6 - 7 r.	9 r.
	maxilla	5 - 6 m. pre	3 m.	5 - 6 r.	7 - 8 r.	10 r.
<b>I 2</b>	mandibula	5 - 6 m. pre	4 m.	5 - 6 r.	7 - 8 r.	10 r.
	maxilla	5 - 6 m. pre	1 r.	6 - 7 r.	8 - 9 r.	11 r.
<b>C</b>	mandibula	8 m. pre	4 m.	7 r.	9 - 10 r.	13 r.
	maxilla	8 m. pre	4 m.	6 - 7 r.	11 - 12 r.	13 - 15 r.
<b>P 1</b>	mandibula	10 m. post	2 r.	5 - 6 r.	10 - 12 r.	12 - 13 r.
	maxilla	10 m. post	1 1/2 r.	5 - 6 r.	10 - 11 r.	12 - 13 r.
<b>P 2</b>	mandibula	18 m. post	2 1/2 r.	6 - 7 r.	11 - 12 r.	13 - 14 r.
	maxilla	18 m. post	2 r.	6 - 7 r.	10 - 12 r.	12 - 14 r.
<b>M 1</b>	mandibula	4 m. pre	novor.	3 r.	6 - 7 r.	9 - 10 r.
	maxilla	4 m. pre	novor.	4 r.	6 - 7 r.	9 - 10 r.
<b>M 2</b>	mandibula	6 - 12 m. post	2 1/2 - 3 r.	7 - 8 r.	11 - 13 r.	14 - 15 r.
	maxilla	6 - 12 m. post	3 r.	7 - 8 r.	12 - 13 r.	14 - 16 r.
<b>M 3</b>	mandibula	5 r. post	8 - 10 r.	12 - 16 r.	17 - 22 r.	18 - 25 r.
	maxilla	5 r. post	7 r.	12 - 16 r.	17 - 22 r.	18 - 25 r.



**Table 26.1** Chronology of tooth development and the order of eruption

Chronology of the deciduous dentition					Chronology of the permanent dentition				
Tooth	First evidence of calcification (months in utero)	Crown completed (months)	Eruption (months)	Root completed (years)	Tooth	First evidence of calcification	Crown completed (years)	Eruption (years)	Root completed (years)
<i>Maxillary</i>					<i>Maxillary</i>				
A	3-4	4	7	1½-2	1	3-4 months	4-5	7-8	10
B	4½	5	8	1½-2	2	10-12 months	4-5	8-9	11
C	5	9	16-20	2½-3	3	4-5 months	6-7	11-12	13-15
D	5	6	12-16	2-2½	4	1½-1¾ years	5-6	10-11	12-13
E	6-7	10-12	21-30	3	5	2-2½ years	6-7	10-12	12-14
<i>Mandibular</i>					<i>Mandibular</i>				
A	4½	4	6½	1½-2	1	3-4 months	4-5	6-7	9
B	4½	4½	7	1½-2	2	3-4 months	4-5	7-8	10
C	5	9	16-20	2½-3	3	4-5 months	6-7	9-10	12-14
D	5	6	12-16	2-2½	4	1¾-2 years	5-6	10-12	12-13
E	6	10-12	21-30	3	5	1¼-2½ years	6-7	11-12	13-14
Unless otherwise indicated all dates are postpartum. The teeth are identified according to the Zsigmondy system.					6	Birth	2½-3	6-7	9-10
					7	2½-3 years	7-8	12-13	14-15
					8	8-10 years	12-16	17-21	18-25
					All dates are postpartum. Teeth are identified according to the Zsigmondy system.				



# Mixed dentition

**Dentition, in which temporary and permanent teeth are both present**

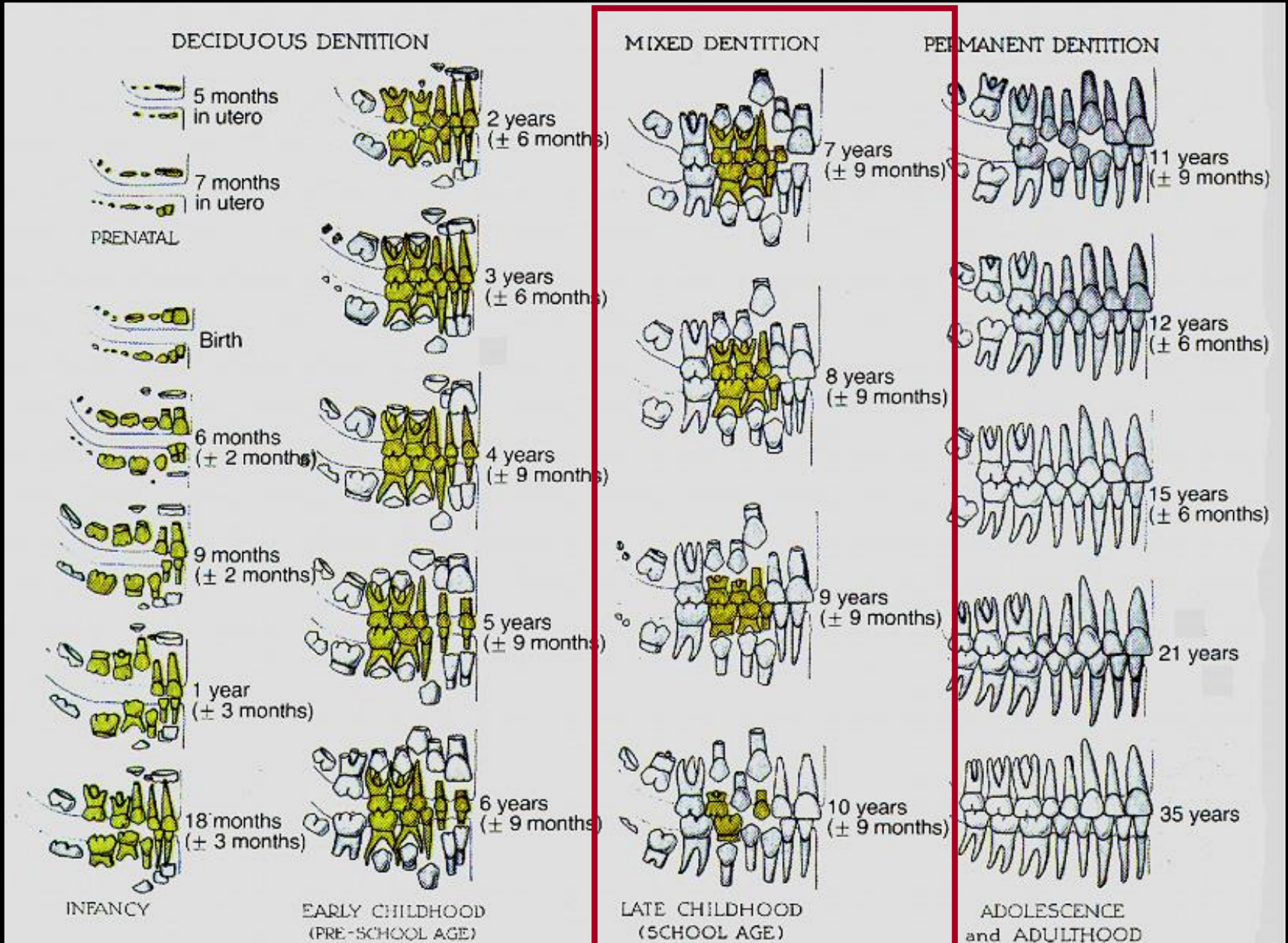
Mixed dentition period - starts **by eruption of the first permanent molar ( $M_1$ )** and ends **by exfoliation of the second temporary molar ( $m_2$ )**

Lasts between **6. - 12. year**

**Exfoliation (shedding) of deciduous teeth recapitulate their eruption**

<b>i1</b>	<b>6. – 8. month</b>	<b>7. year</b>
<b>i2</b>	<b>7. – 12. month</b>	<b>8. year</b>
<b>c</b>	<b>15. – 20. month</b>	<b>12. year</b>
<b>m1</b>	<b>12. – 16. month</b>	<b>10. year</b>
<b>m2</b>	<b>20. – 30. month</b>	<b>11. – 12. year</b>

# Mixed dentition



Deciduous teeth are coloured yellow

# Congenital dental malformations



# Congenital dental malformations

## Teeth number anomaly

Increased number of teeth

Rudimentary

Supplemental

Decreased number of teeth

Hypodontia

Oligodontia

Anodontia

## Fused teeth

dentes confusi

dentes concreti

dental druse

## Tooth shape anomalies

### Size anomalies

Macrodontia

Microdontia

### Anomalies in the hard tissues formation

Enamel

Dentin

Cementum

### Tooth positions anomalies

protrusion

transposition

rotation

heterotopy

retention

### Anomalies in eruption (related to time)

dentitio tarda

dentitio praecox

## Odontomas



# Redneck Bird Dogs

Who says pets don't look like their owners?

# Numerical abnormalities

## a) Dentes supernumerarii (hyperdontia)

more frequent in permanent dentition, the shape of teeth is a normal or garbled (odontoid)

paramolar - molars located labial to molars // distomolar - molars located distal to molars

parapremolars, distopremolars

**mesiodens - the upper middle**

**incisor (maxillary central incisor)**



Obr. 22, 23 Extrahované mesiodenty čípkovité (vlevo); hrbolkového a soudkovitého typu (vpravo).



Obr. 24, 25a Prořezaný čípkovitý mesiodens (vlevo); totéž v dočasném chrupu (vpravo).



**Mesiodens** - in the gap between the upper middle incisors (spherical or conical shape)

**Dens parapremolaris** - supernumerary tooth on the bucal or palatal side or **dens distopremolaris** (between P2 and M1)

**Dens paramolaris** - between the first and second molars on the vestibular side

**Dens distomolaris** - supernumerary 4th molar (located distally to the 3rd molar)

**Dentes prelactales (dentes natales)** - rare; small supernumerary teeth present at birth, with a small crown and no root (occurring in the region of the lower incisors)

*diferenc. dg.: dentitio precox*

Genetic background or hormonal problems - adrenal hyperplasia



### b) Hypodontia

number of lacking teeth is lesser than 6 - most often  $M_3$ ,  $I_2$ ,  $P_2$  (lower jaw)

Occurrence: 0.7% (temporary), **2%** (perm.) of individuals ( $M_3$ ,  $I_2$ ,  $P_2$  /lower)

### c) Oligodontia

number of lacking teeth is more than 6,

mostly teeth of the same type lack

familiar occurrence, AD inheritance

### c) Anodontia

rare, associated with total dysplasia of the ectoderm and ectomesenchyme





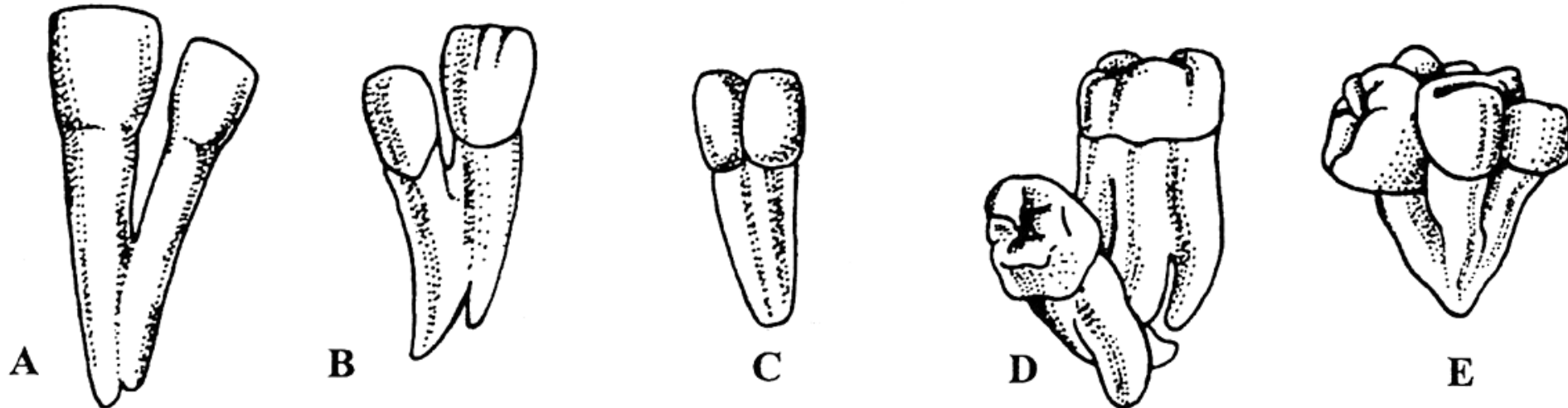
# Fused teeth

## Dentes concreti and dentes confusi (double teeth)

**concreti** - adjacent teeth coupled with their roots - **A,B** (separate dental cavities)

**confusi** - adjacent teeth coupled in the full length (from the crown to the apex) - **C**  
have a common dental cavity

most often caused by a fusion of tooth buds  
(rarely by division of one tooth bud - dentes geminati)



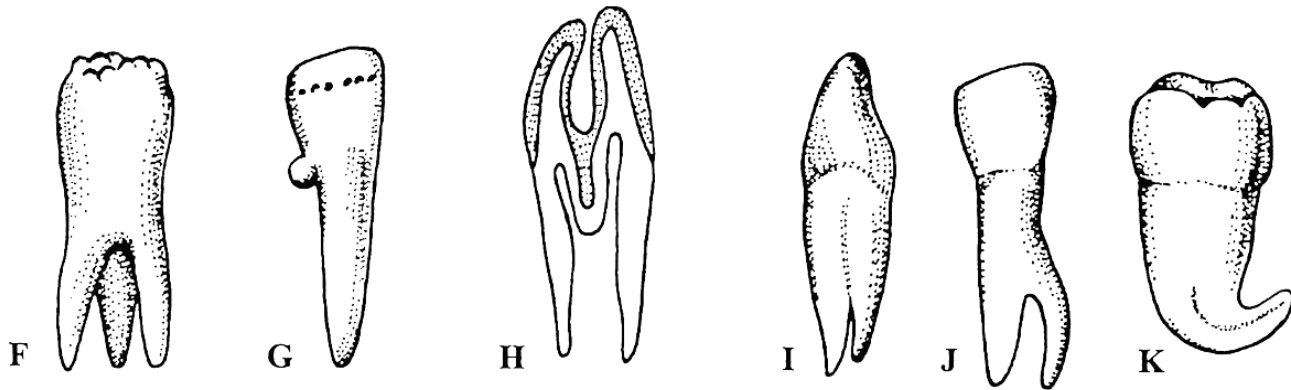
## Anomalies of tooth shape

Common and concerned a crown, neck or root

Caused by activity of aberrant ameloblasts or by defectly developed

Hertwig's epithelial sheath

Examples: conically shaped crowns of lateral incisors, reduced or increased length of the root, reduced or increased number of the root branches etc.



Obr. 68 Kolénkovité zahnutí radixů horních řezáků.



## Size of teeth

**Macrodontia and Microdontia** - increased/decreased activity of individual parts or the entire dental bar (disproportion between the size of teeth and jaws)

**Isolated** (*microdontia, macrodontia*)

**Complete** (*macrodontism, microdontism*)



# Anomalies of hard tooth tissues

## Enamel hypoplasia

occurs when activity of ameloblasts is finished in pre-term

**findings:** crown shows usually abnormal shape; enamel is thinner; fissures, scratches, and holes are seen on it  
isolated teeth or group of teeth

**Causes:**

**rachitis, hypoparathyroidism**

**syphilis congenita (Hutchinson incisors with semilunar edges, mulberry molars)**

Inflammatory affections of deciduous teeth connected **with affections of tooth germs of permanent teeth** - enamel of permanent teeth crowns has fissures and is pigmented - Turner's teeth)

**treatment of tetracyclin antibiotics**



## Amelogenesis imperfecta

Always hereditary cause, inheritance of AD, AR, but also linkage to the X chromosome  
3 forms: hypoplastic, hypomaturation and hypomineralization

**Hypoplastic:** local defects (fissures, pitting) or overall thinned enamel, affecting both dentition, temporary or permanent, AD inheritance  
(ameloblasts are not functional throughout amelogenesis)

**Hypomaturation:** normal enamel thickness, but pigmented appearance and yellow-white to brown colour compared to healthy enamel, softer and easily peels away from dentin  
Occurrence temporary, permanent or both dentitions, AR inheritance

**Hypomineralisation:** the enamel is of normal thickness after eruption, but is very soft.  
Soon disappears during natural attrition (it can also be removed with sharp objects)  
patients complain of sensitivity to cold and heat  
1 in 20 000 school-age children



# Dentin

## Dentinogenesis imperfecta

disorder in the development of dentin, which is pinkish to brownish and contains a reduced number of dentinal tubules  
**teeth are smaller, gray-blue color to brownish color**

enamel is normal, but is easily separated from dentin (fast abrasion), the in temporary teeth are usual crown fracture

rare, AD inheritance

## Sclerosis of dentin

caused by obliteration of dentinal tubules



# Cementum

**hypercementosis** (hereditary)

**aberrant cementum**

in the periodontium **cementicles**



## Anomalies of tooth position

**Protrusion** - longitudinal axis inclined labially

**Retrusion** - longitudinal axis inclined orally (into the oral cavity)

**Transposition** - exchange of space between 2 adjacent teeth in the dental arch (canine / incisor or first molar / canine)

**Rotation** - rotation of the tooth around the longitudinal axis (mesiorotation, distorotation)

**Heterotopia** (anomalous eruption) (heteros other, topos - site location)

the tooth was established and developed at an atypical site (isthmus faucium, hard palate) or cut outside the maxillary arch (vestibularly or lingually)

## Anomalies in eruption (time)

**Dentitio tarda** - no tooth is erupted until the end of the 10th month

**Dentitio praecox** - the first temporary tooth erupt before the 4th month of age