

Permanent dentition, Development, Congenital dental malformations

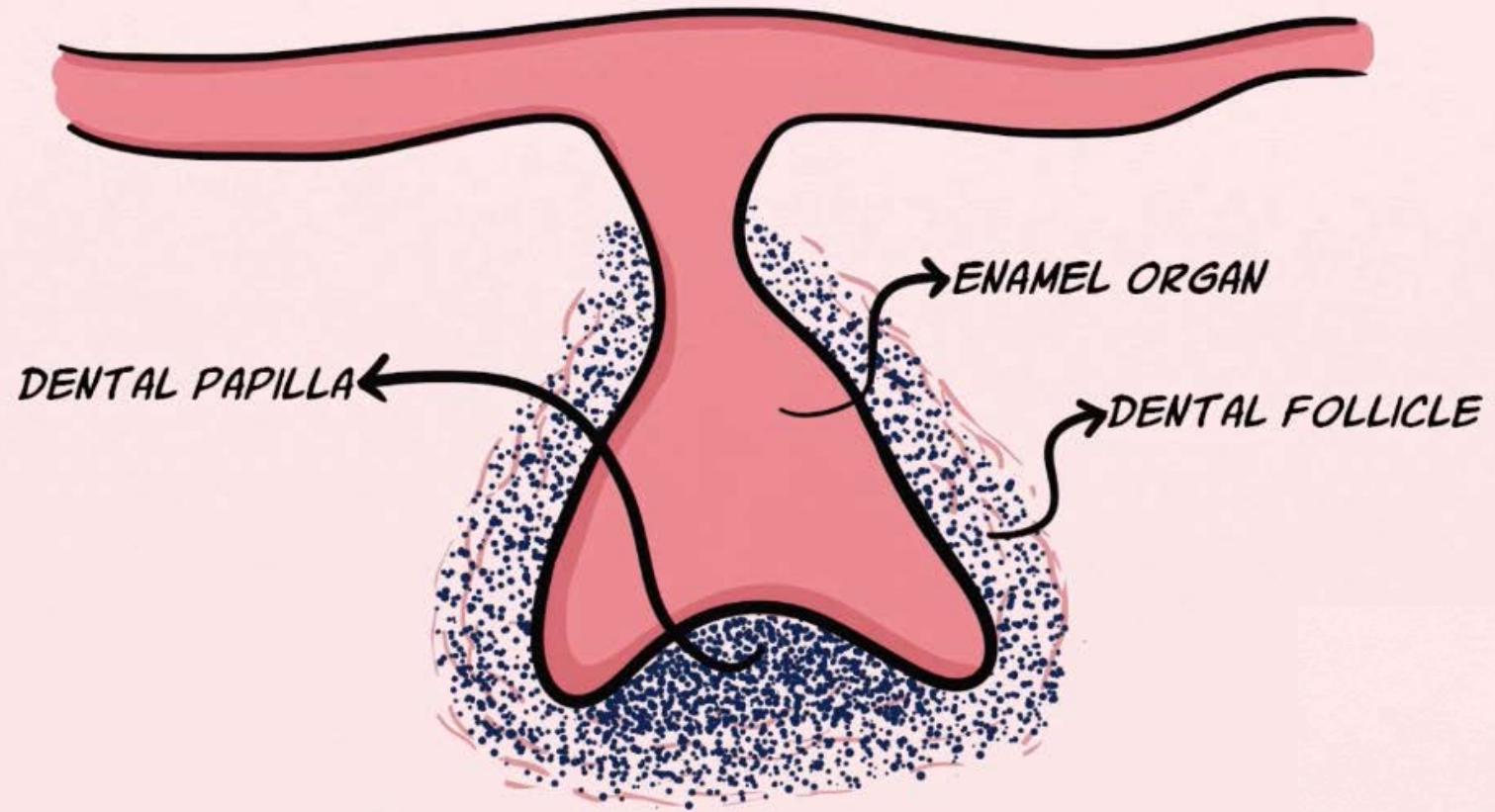
2. 6. 2021

Zubní pohárek a zvonek ve světelném mikroskopu

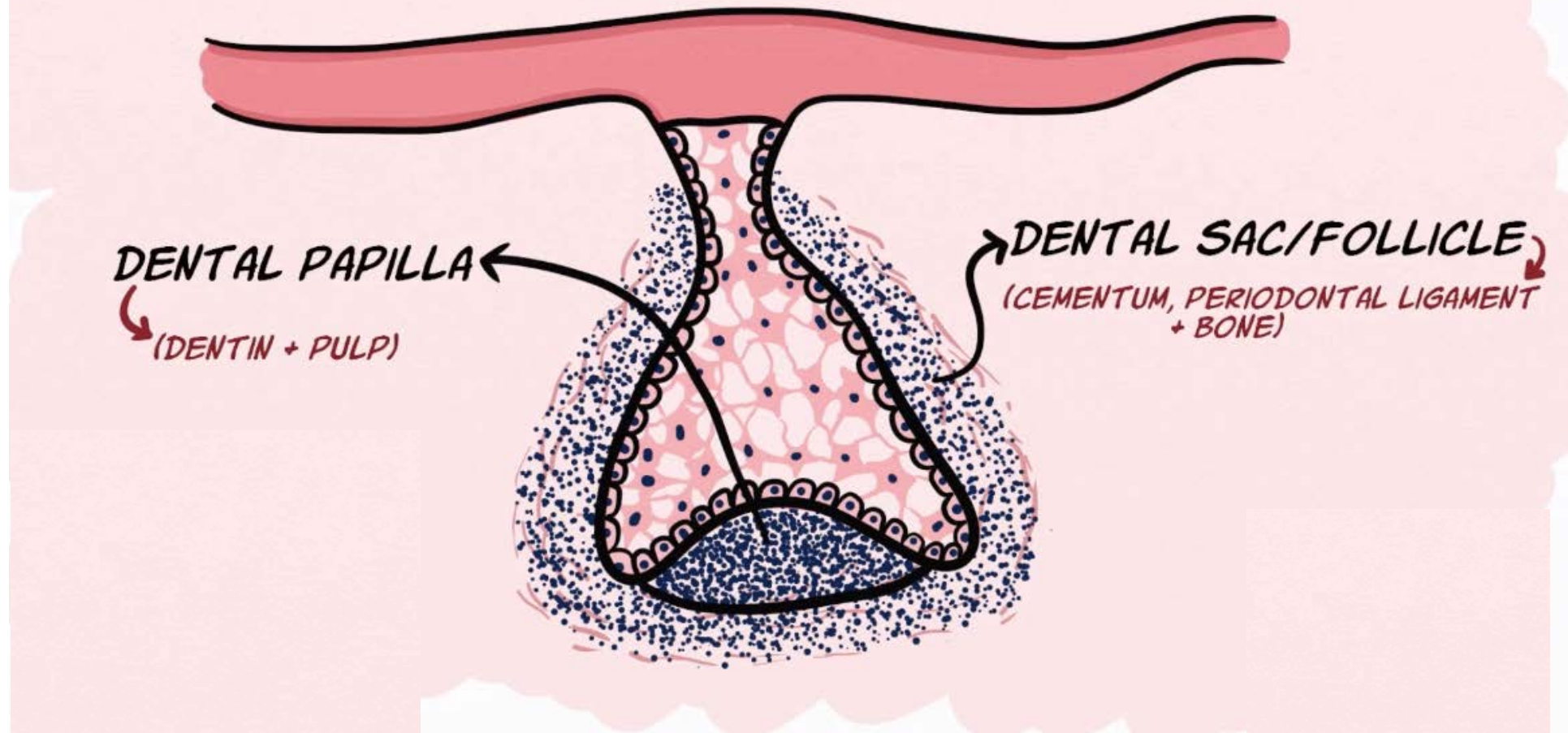
Preparát:

Vývoj zubu (Homo) - fetus stáří asi 15 - 16 týdnů

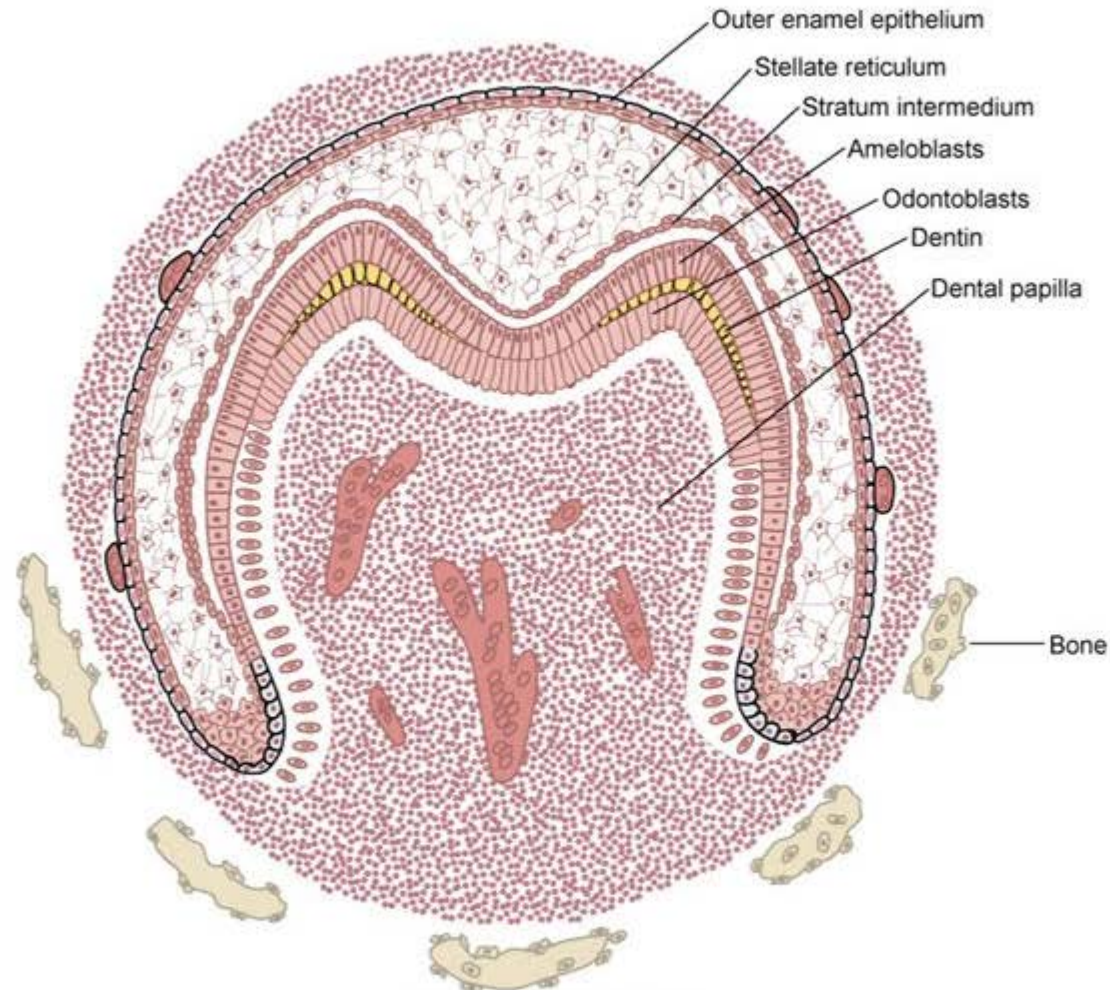
TOOTH GERM/DENTAL ORGAN = ENAMEL ORGAN + DENTAL PAPILLA + DENTAL FOLLICLE



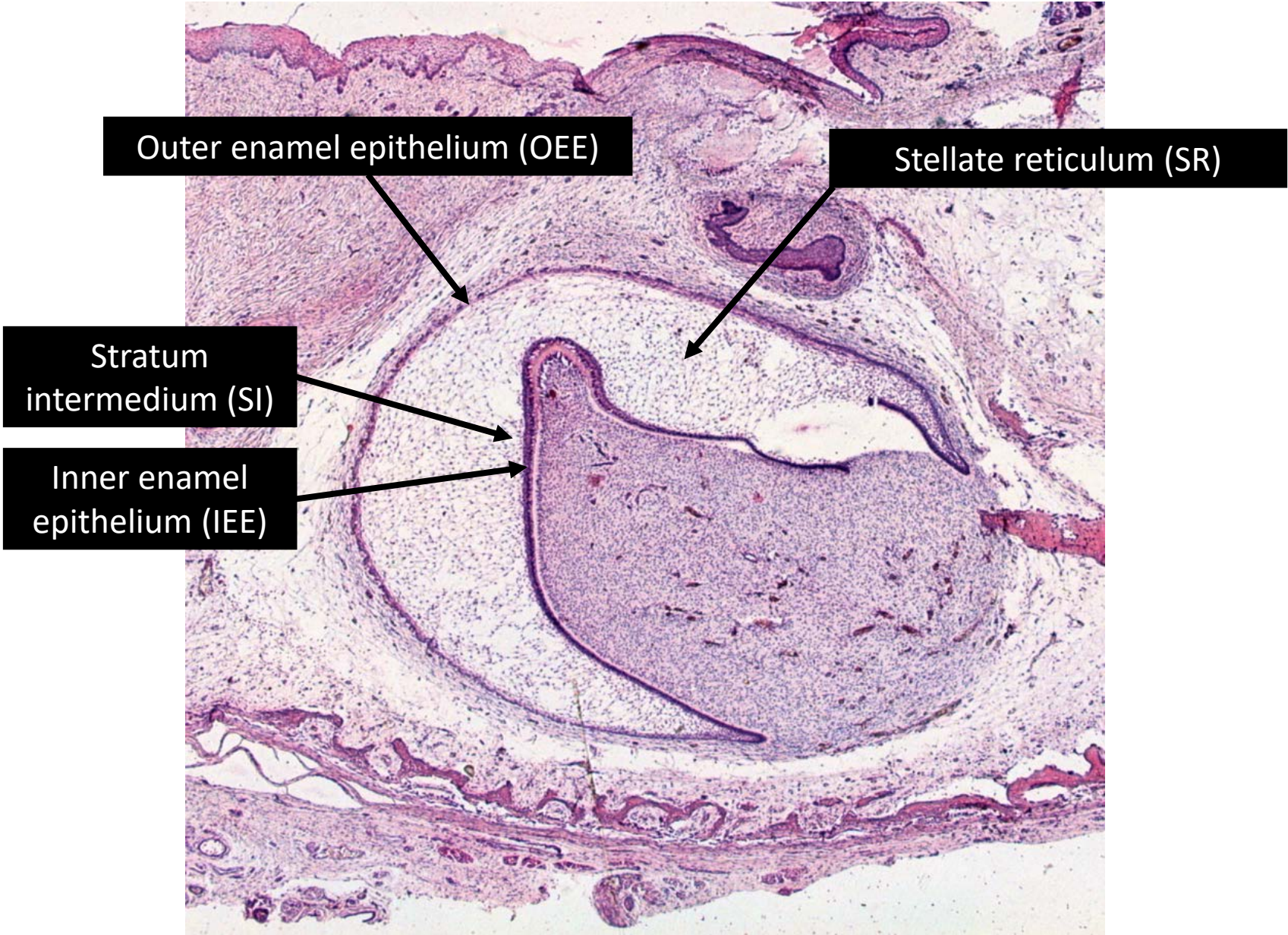
CAP STAGE

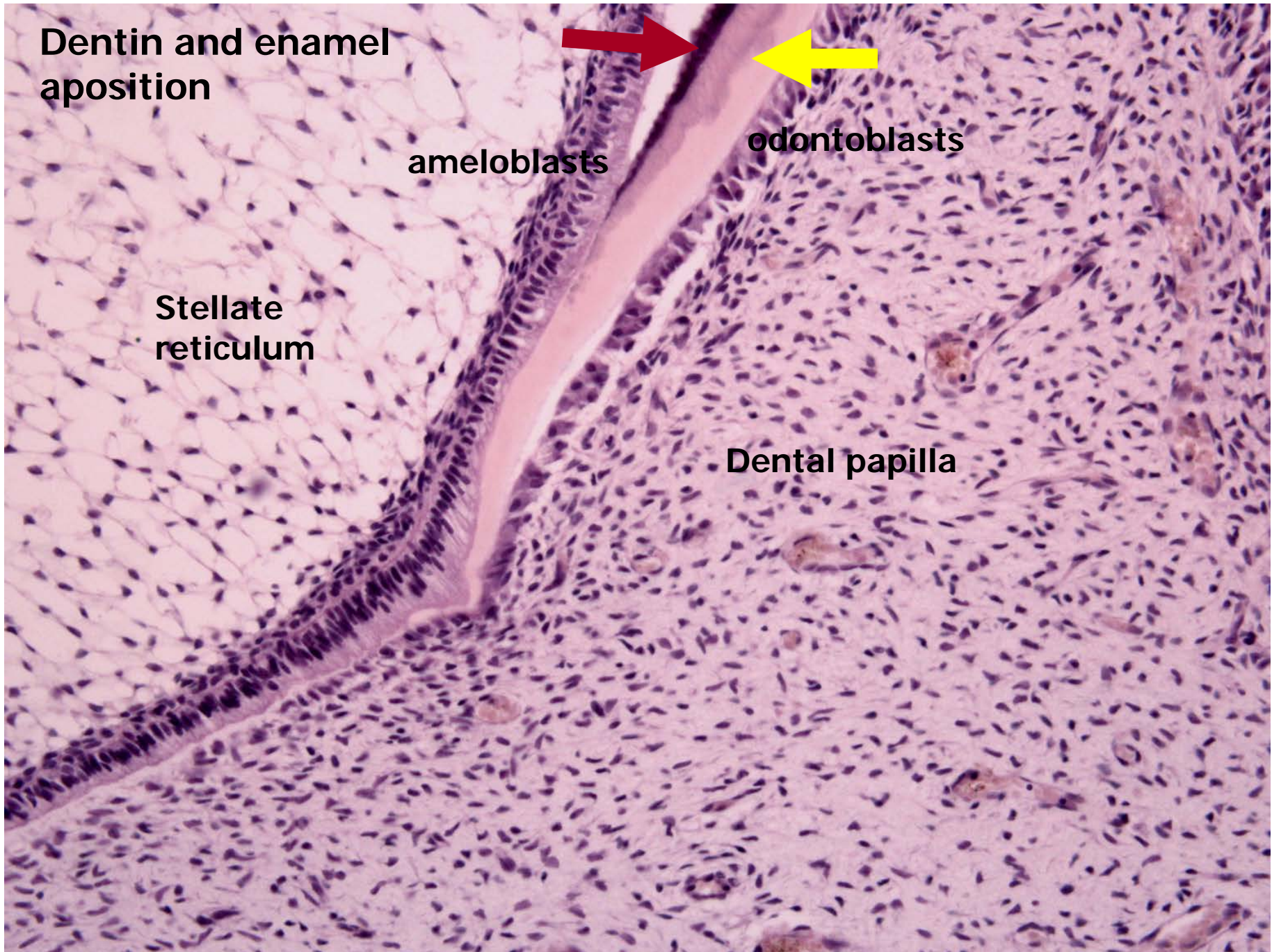


Bell Stage



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Development of dental pulp and cavitas dentis

The pulp develops from the ectomesenchyme occupying the central portion of the dental papilla

Ectomesenchyme differentiate into fibroblasts and fibrocytes and odontoblasts.

Histiocytes and plasmocytes populate the pulp from the blood

First **blood vessels** occur **before deposition of dentin matrix** (end of 3 month)

cavitas dentis - firstly develops in the crown, and later in the root during the teeth eruption; its shape corresponds to the shape of the dental papilla

ECM pulpy (kolagenní a retikulární vlákna + amorfní) jsou produkována fibroblasty



Development of PDL

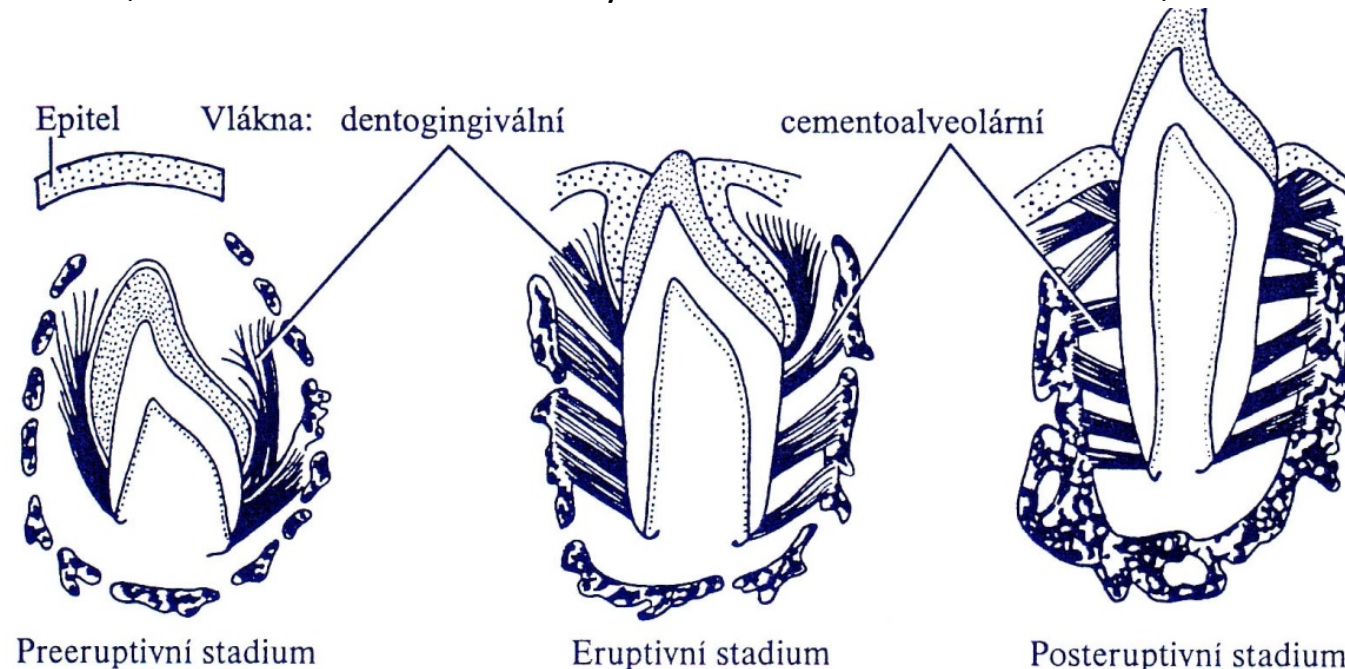
Develops from the ectomesenchyme of the dental sac (follicle)

Is initiated when the crown is completed, during root formation and develops together with cementum apposition

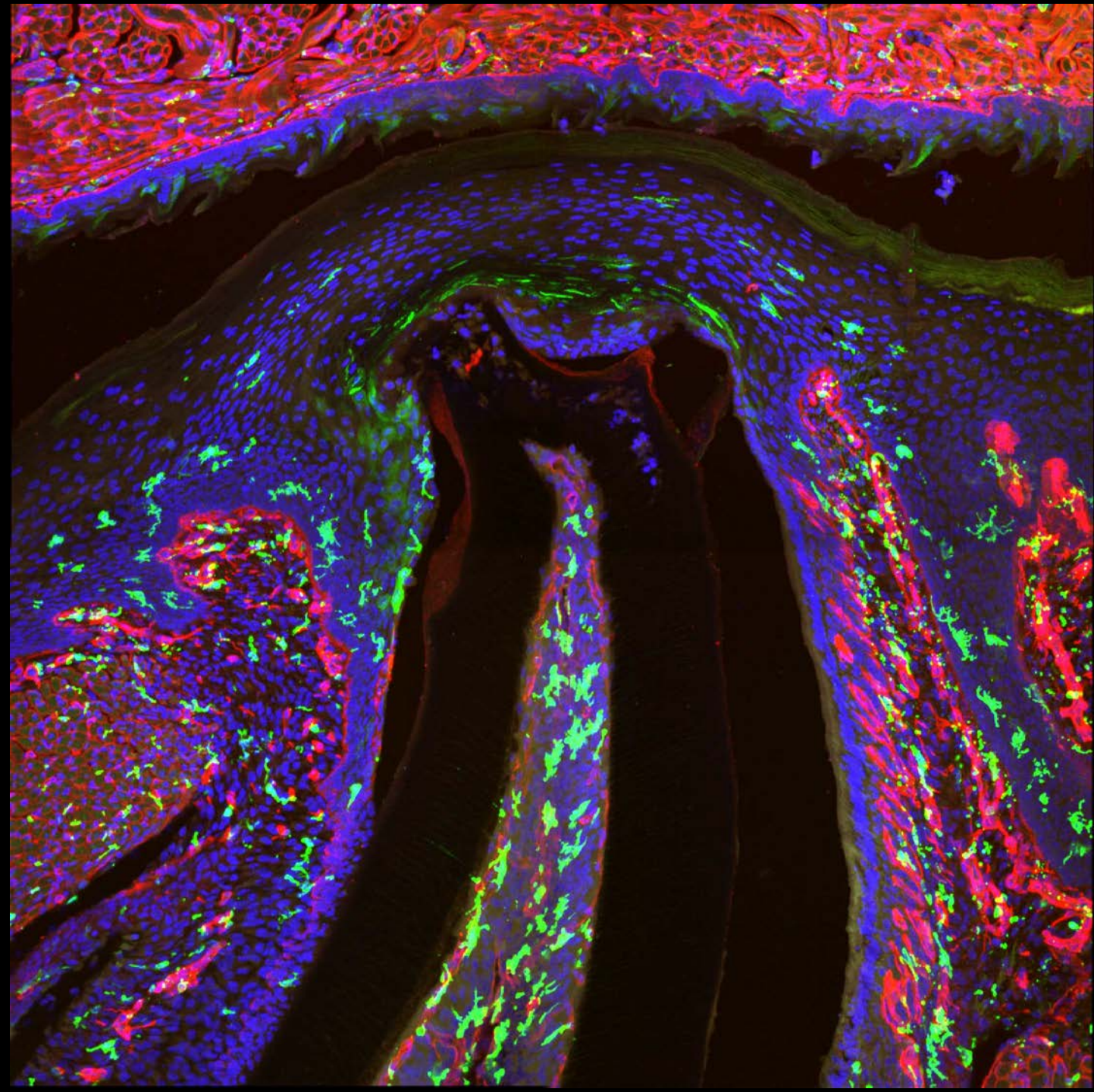
Formed by secretory function of fibroblasts (ectomesenchymal origin)

Fibers of **gingival group** with parallel course to the surface of the tooth **develop as the first**, thereafter interdental and principal fibers the intermediate plexus is differentiated as the last

When the PDL development is finished, some cells retain the ability to differentiate into fibroblasts, osteoblasts and cementoblasts



Eruption



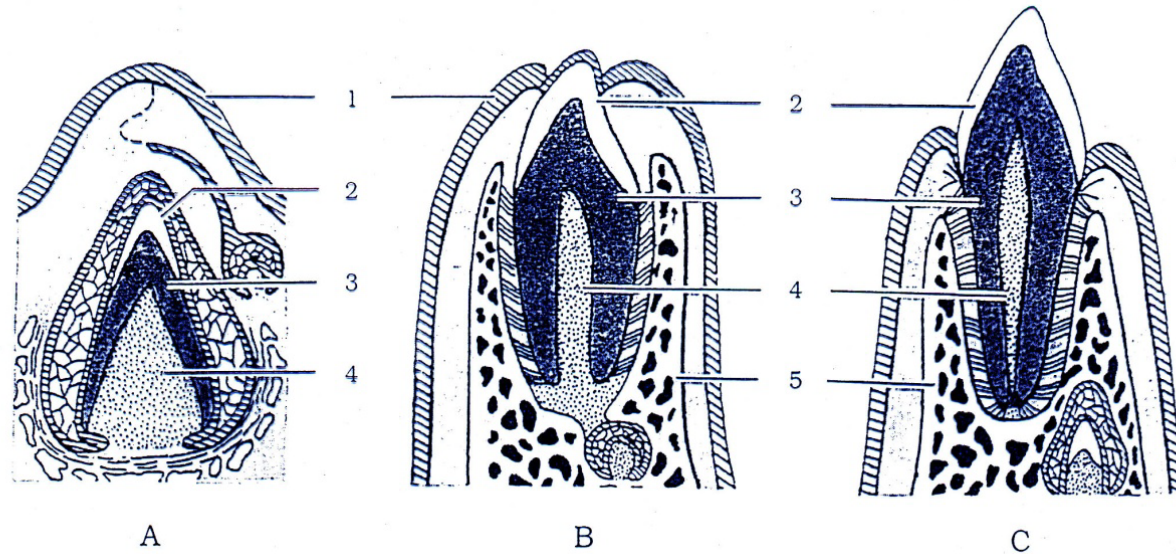
Eruption

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**

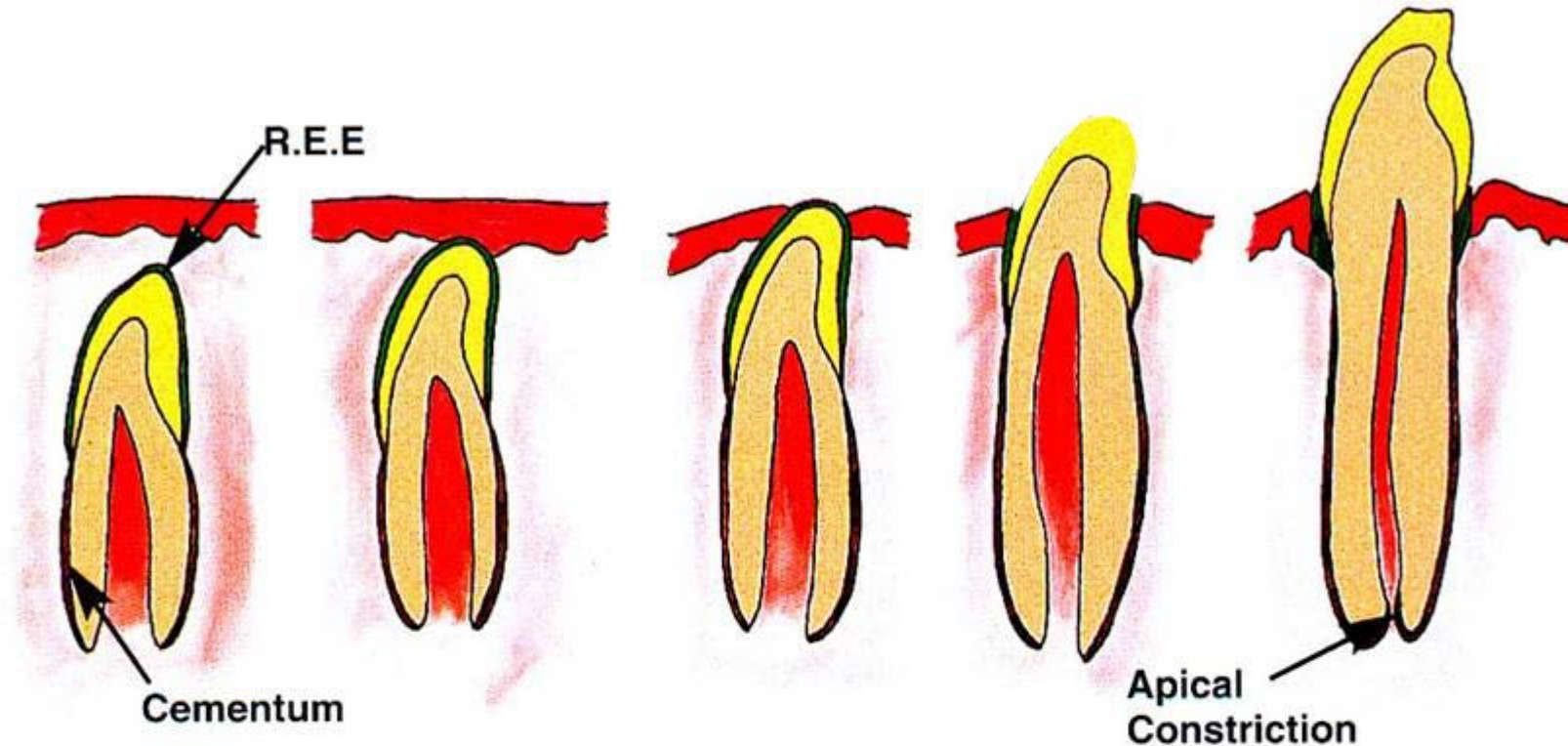
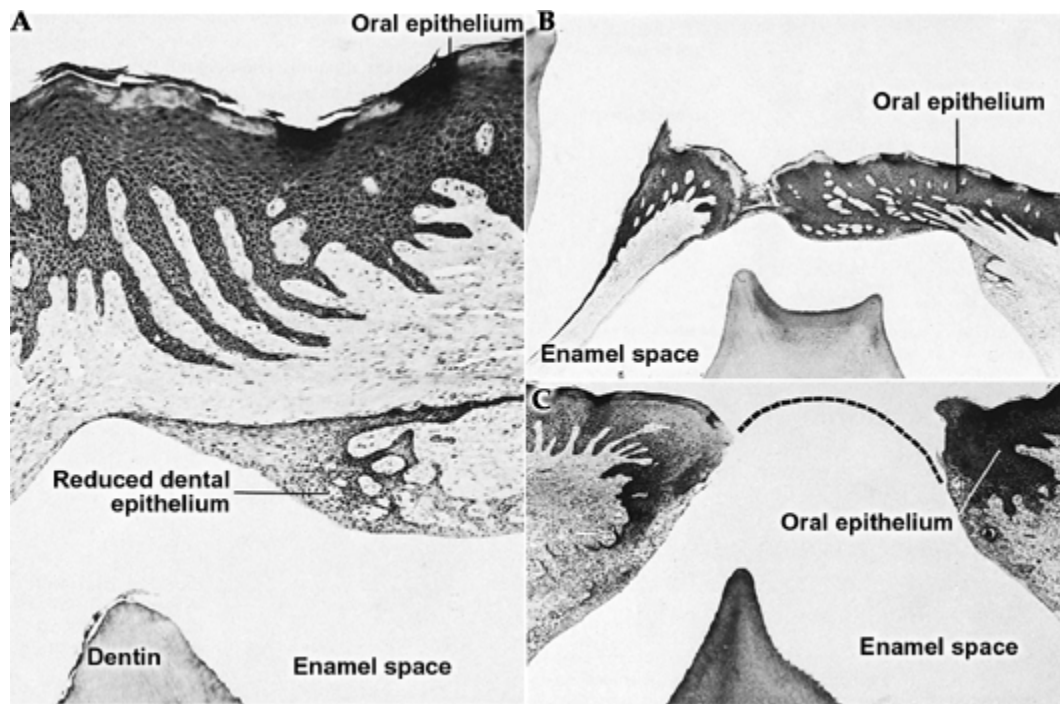
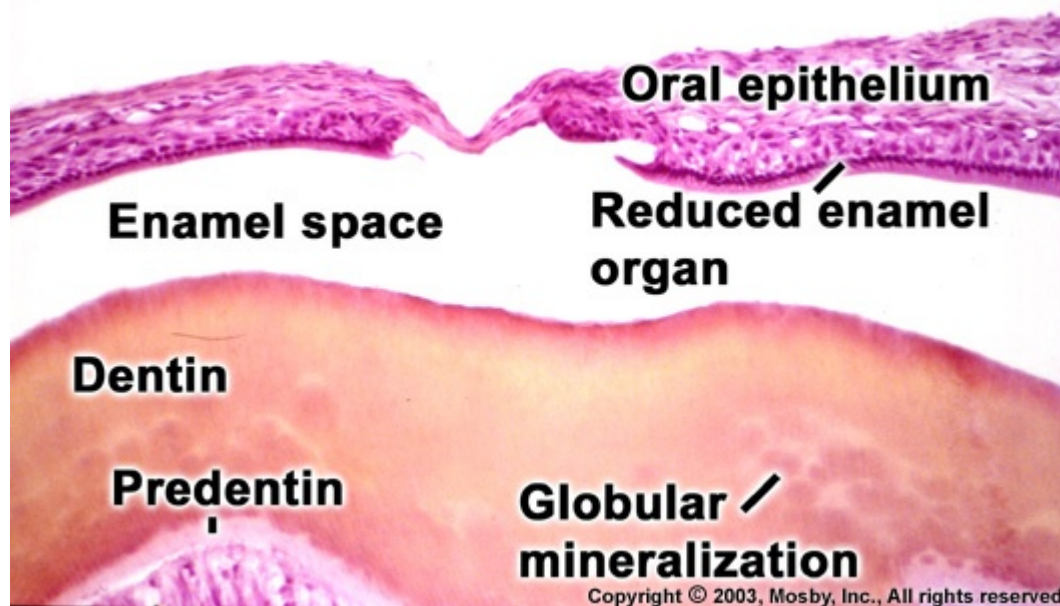


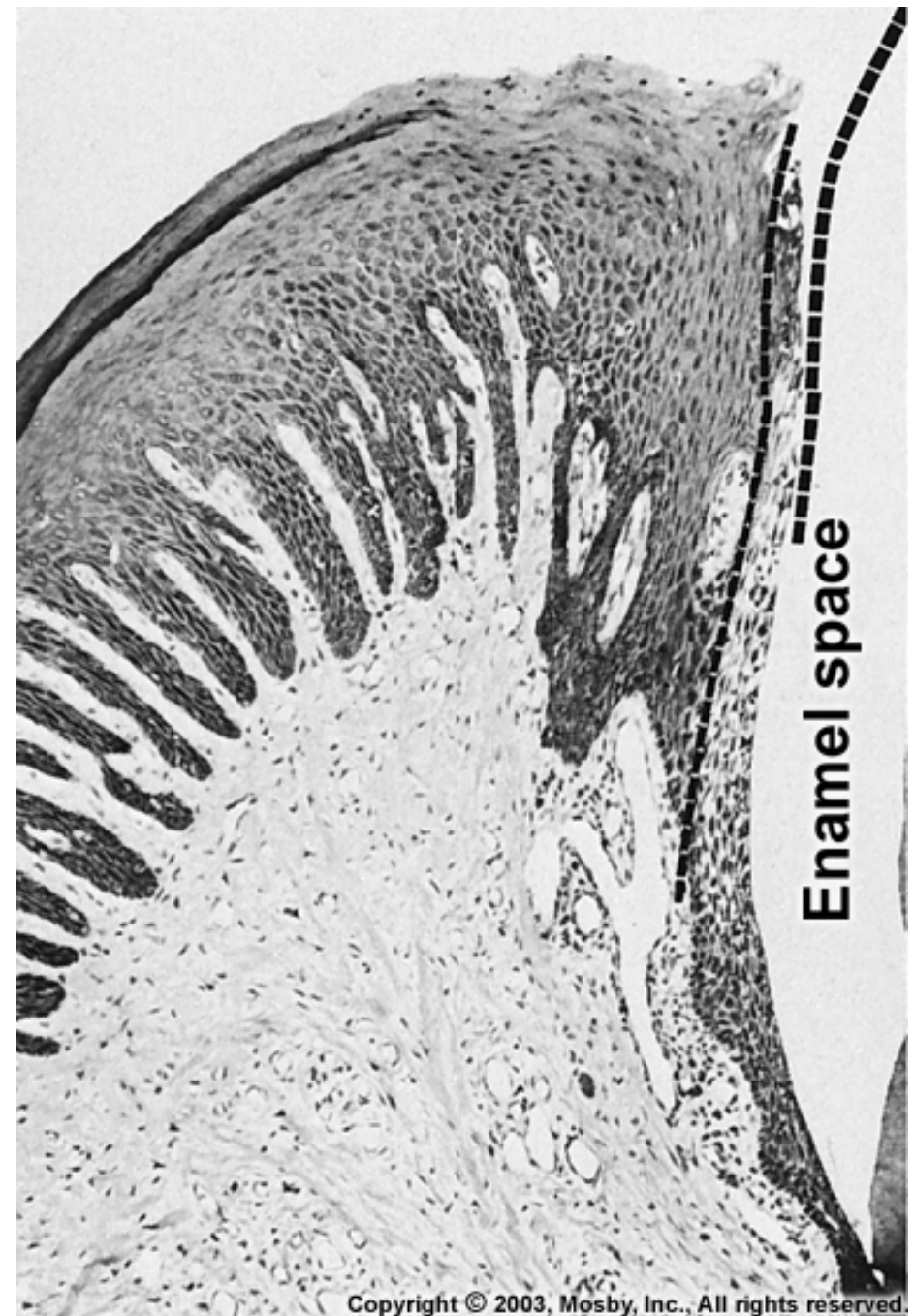
Fig. 26.6 Diagrammatic representation of the development of the dentogingival junction during the eruption of a tooth. R.E.E. = Reduced enamel epithelium (green). Red outline delineates oral epithelium.



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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*)

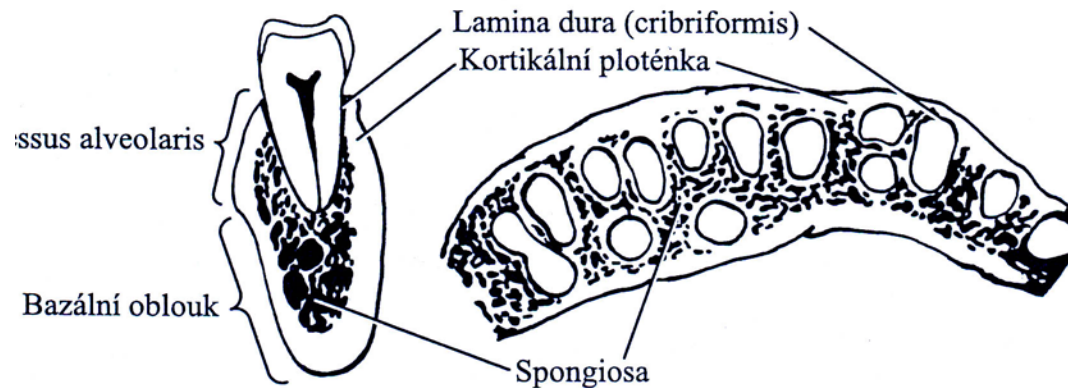
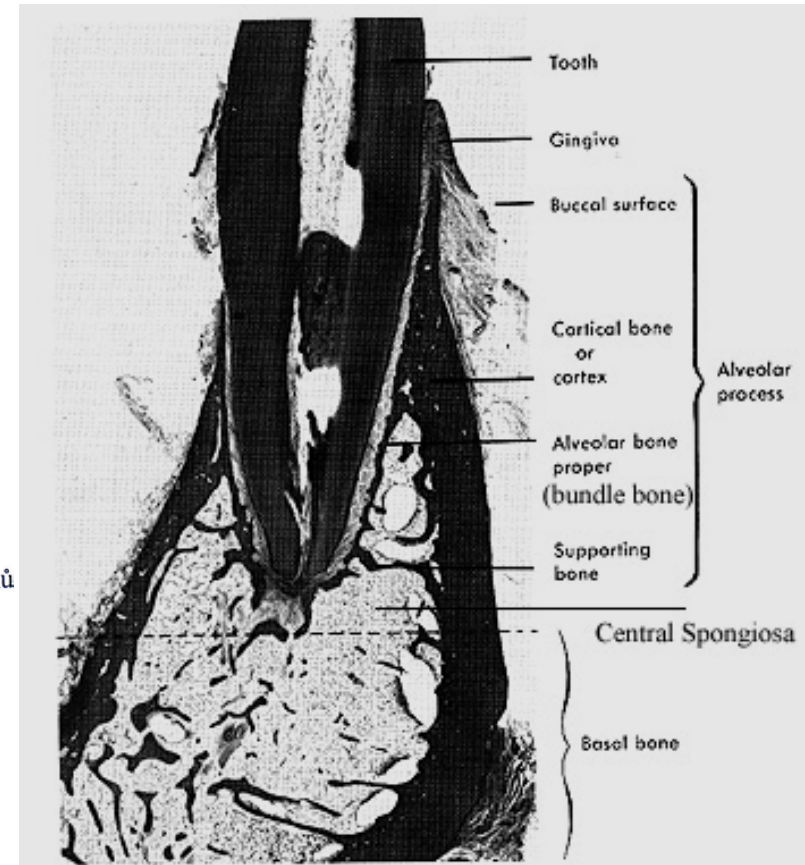


Fig. 25-5. Podélný a příčný (horizontální) řez mandibulou demonstruje stavbu alveolárních výběžků a alveolární kosti.



Timeline of primary dentition eruption

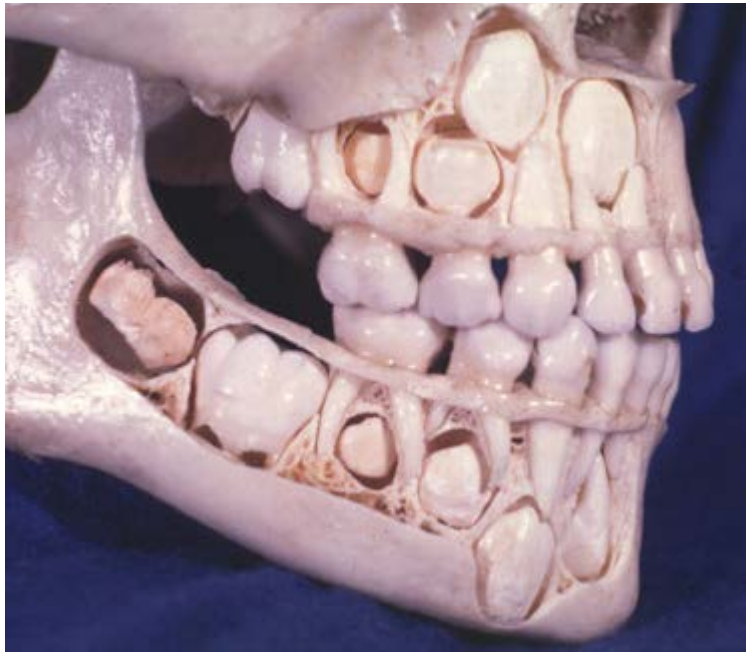
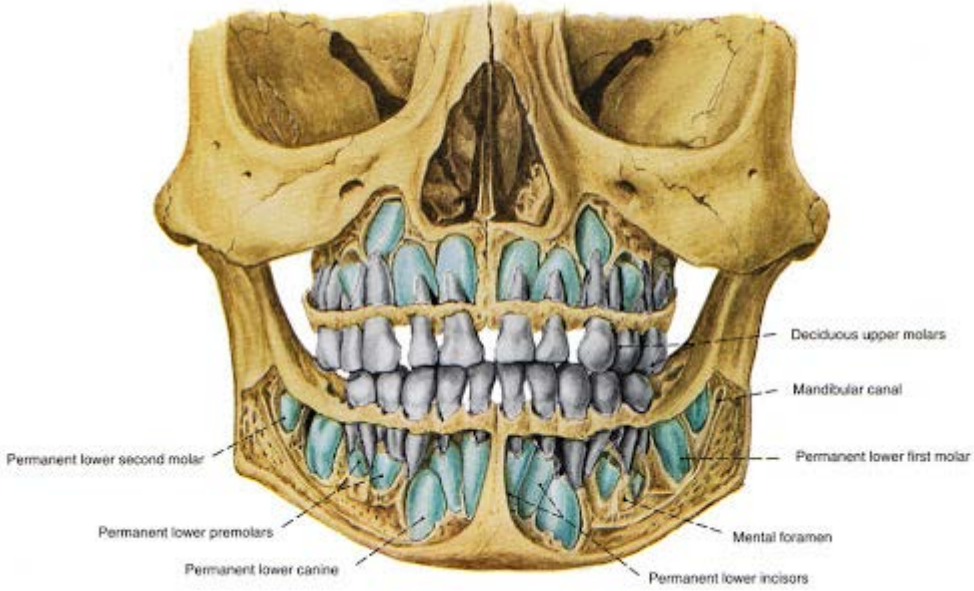
		Exfoliation (shedding)
i1	6. - 8. months	7 year
i2	7. - 12. months	8 year
c	15. - 20. months	12 year
m1	12. - 16. months	10 year
m2	20. - 30. months	11-12 year

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

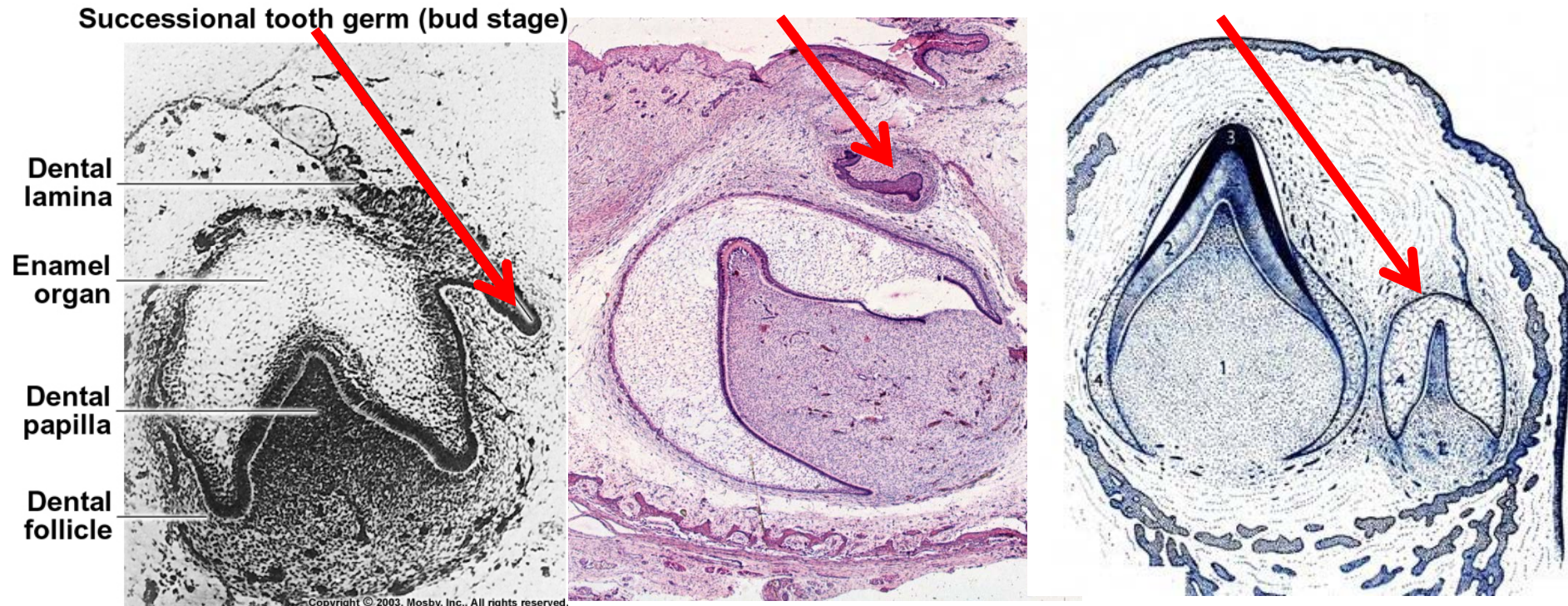
Takes a substantially longer period than primary dentition

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**

I₁, I₂, C, P₁, P₂, develop from a successional dental lamina

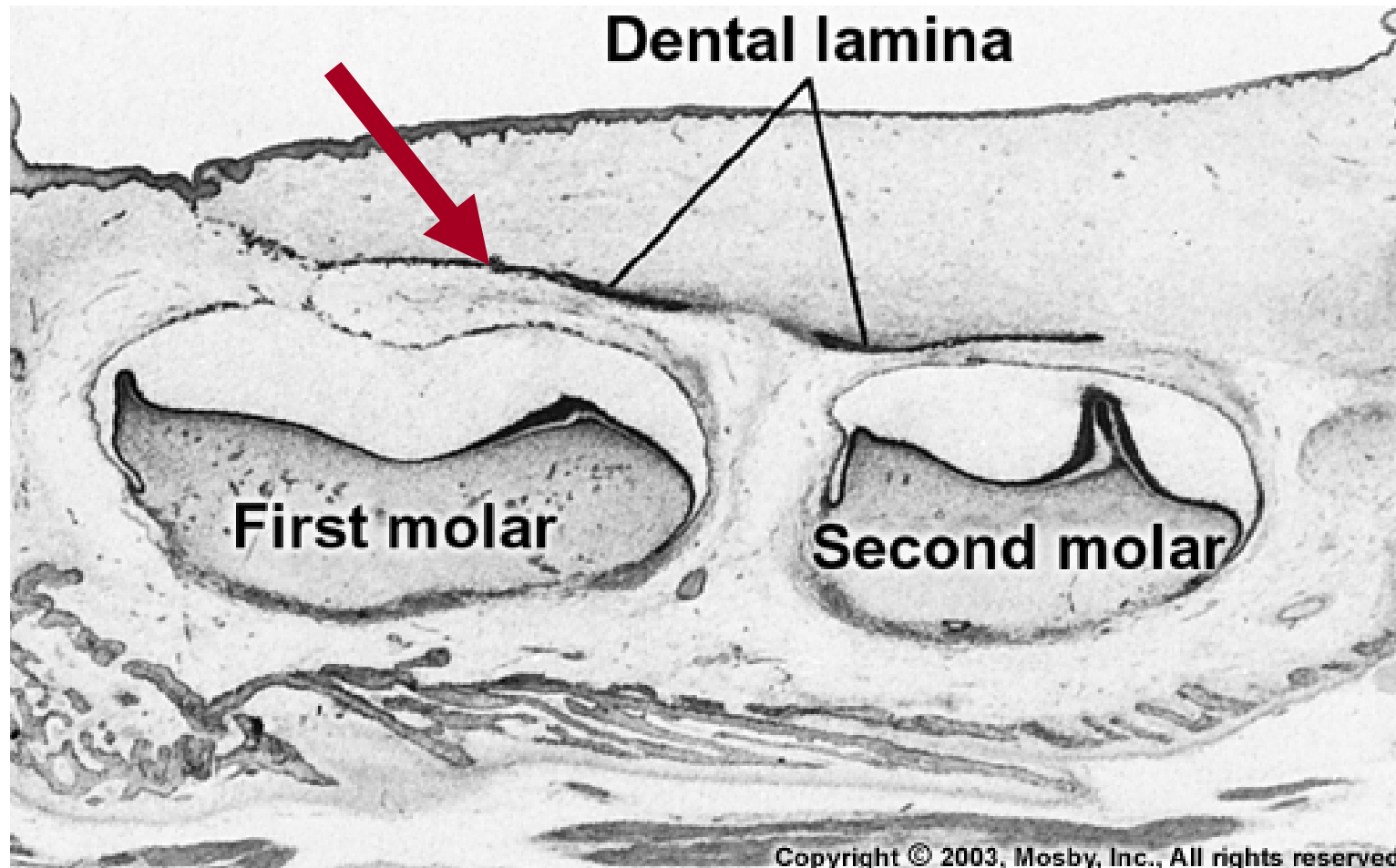
Successional dental lamina is a derivative of primary dental lamina and is segmented (in contrast to primary dental lamina)



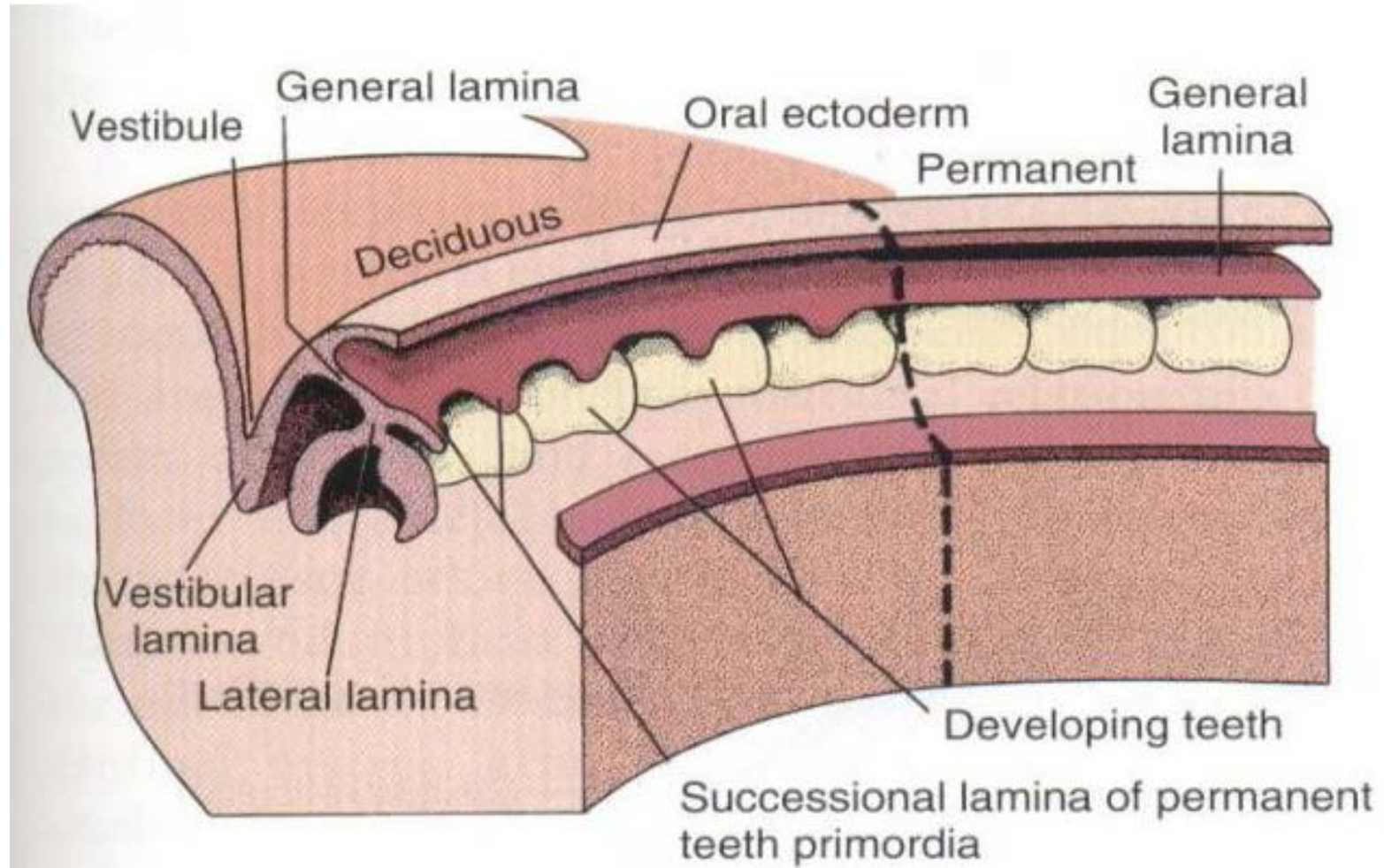
Permanent dentition development

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

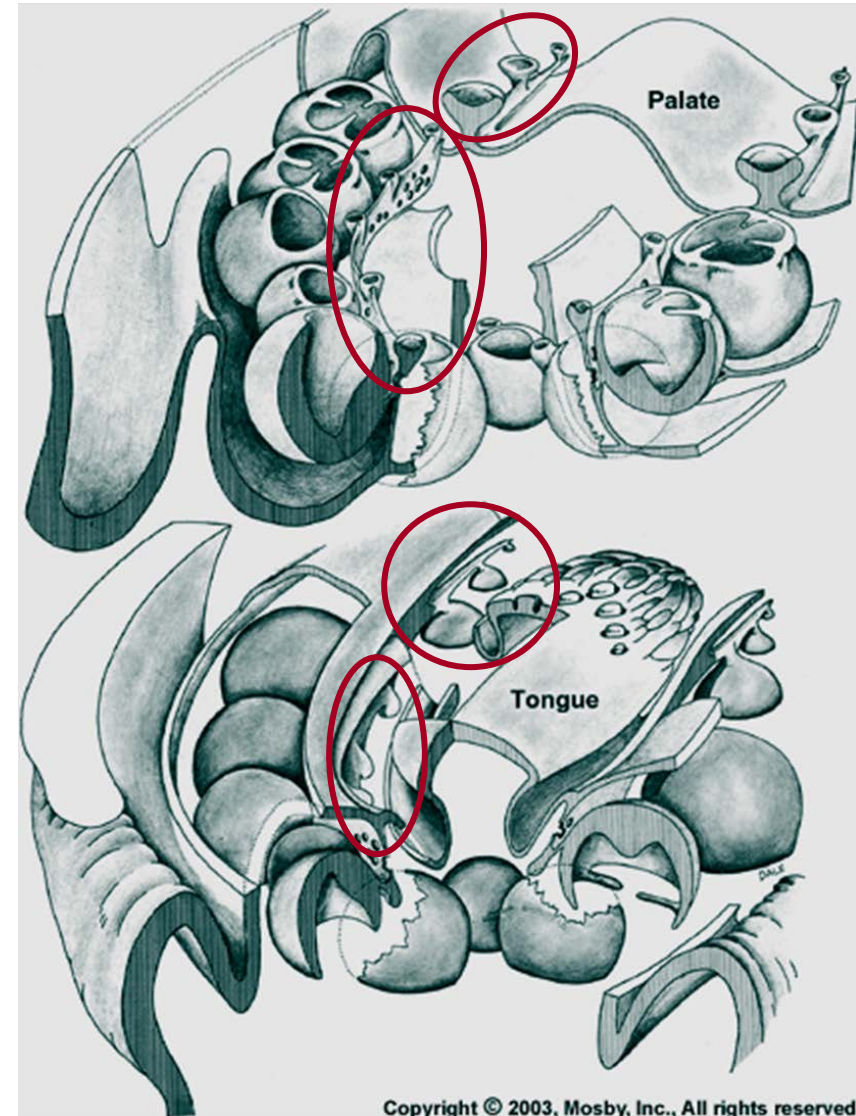
Prenatally:

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

Postnatally:

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

Permanent molars developmentally belong to teeth of temporary dentition



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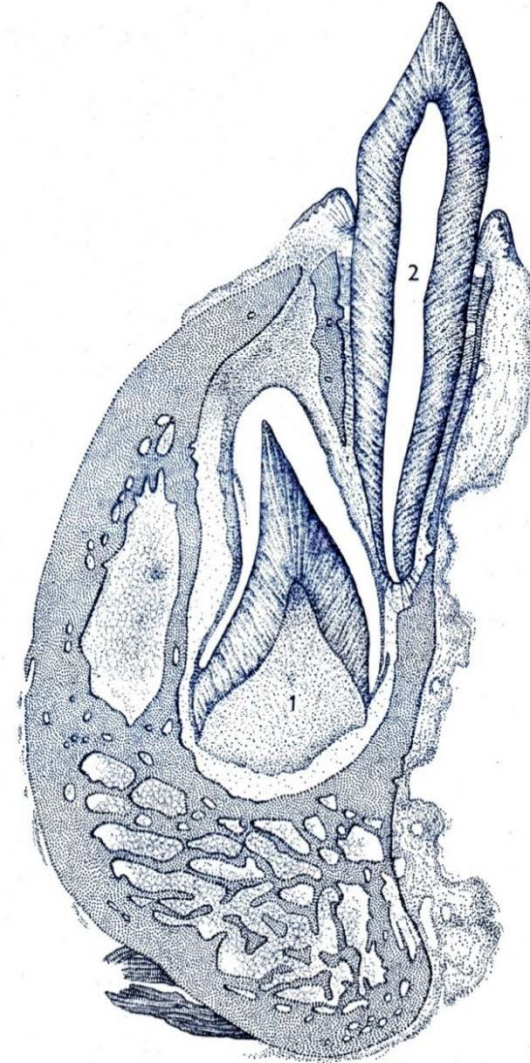
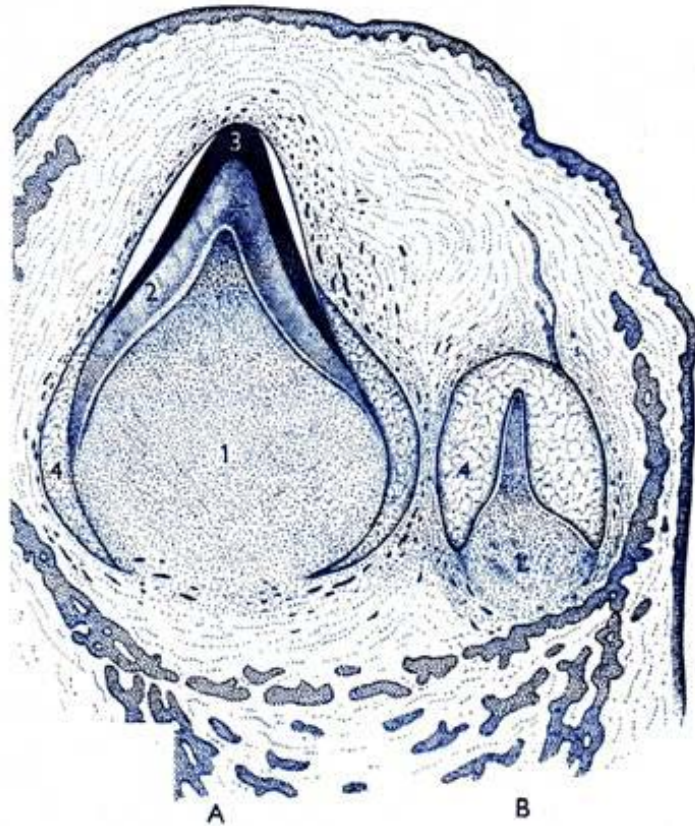
foetus - 6 month old

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

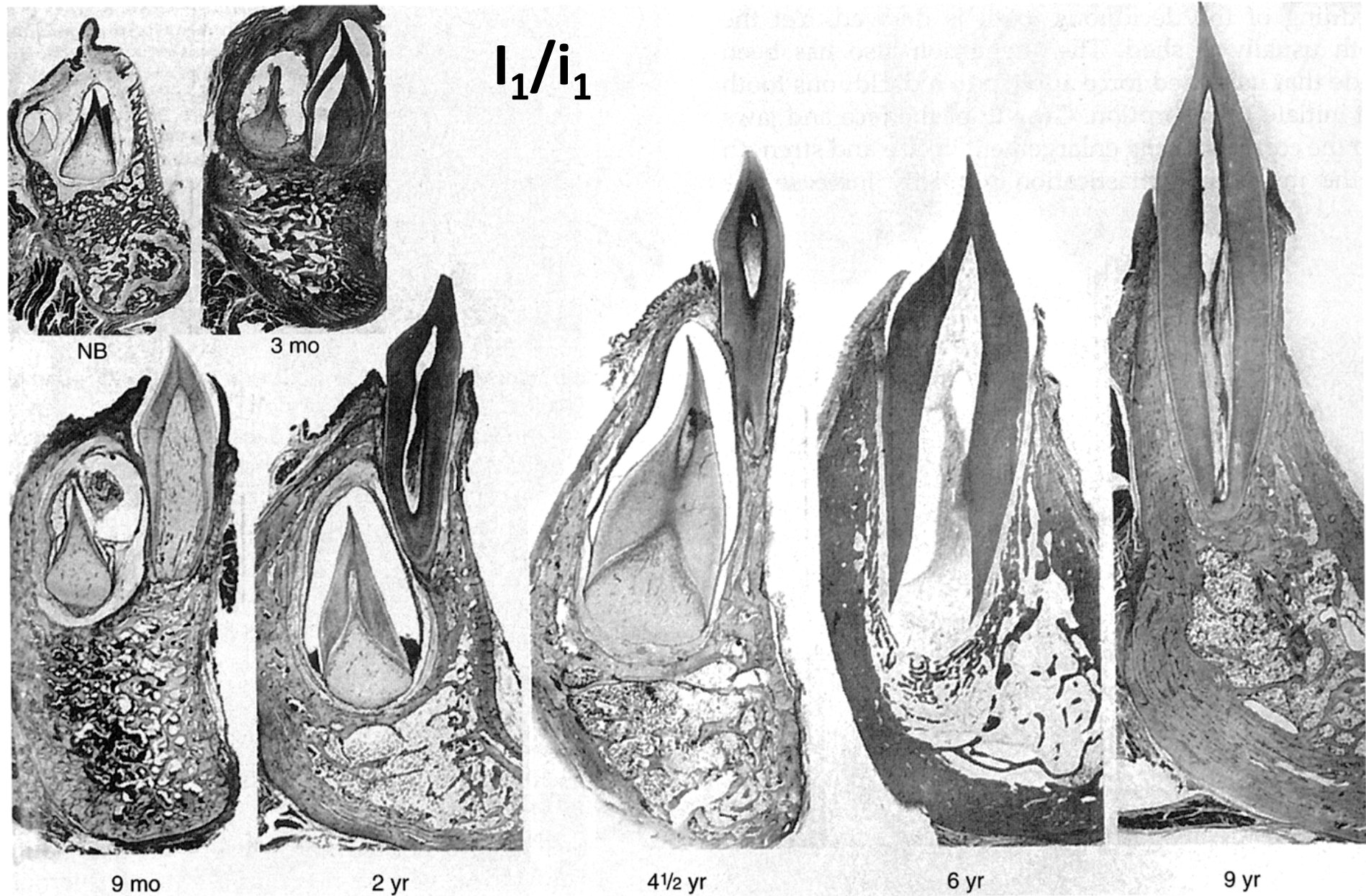
During development, the primary tooth grows and secondary takes place under the root of the temporary tooth

The follicles of both teeth separates the bony barrier



Obr. 83.
Věnová zubu. Dočasný zub ve stadiu sponice (A), časné stadium

Bucolingual crosssections through incisors (newborn - 9 years)



Eruption of permanent teeth

Eruption of permanent molars are similar to temporary teeth

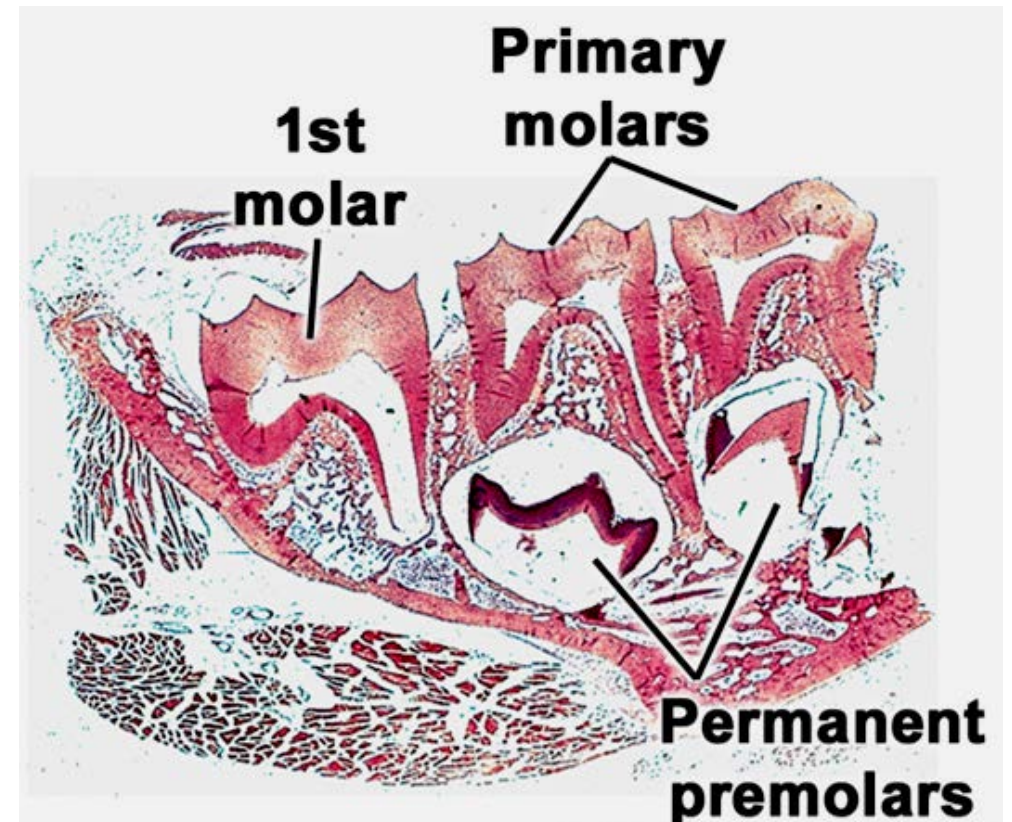
For permanent incisors, canines and premolars primary dentition needs to be removed

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

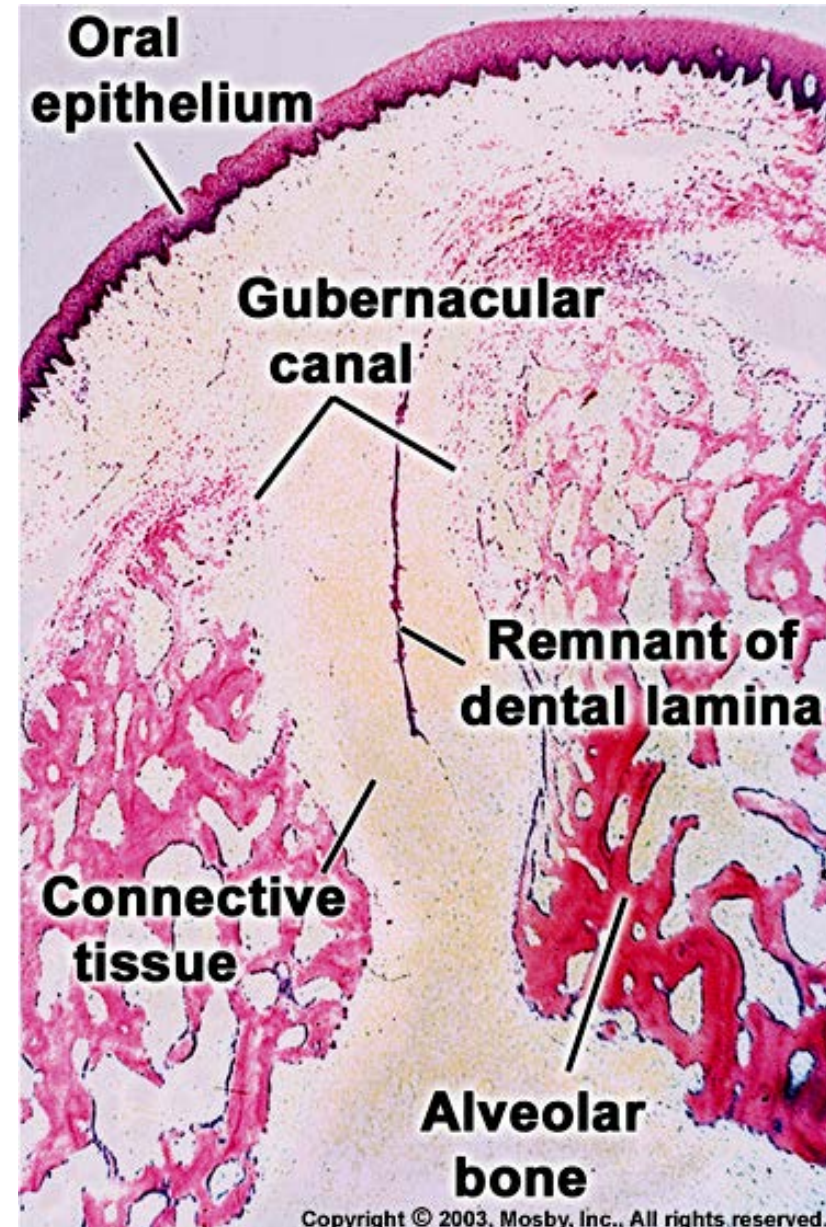
conversion into loose collagenous connective tissue (it still retains the ability of redifferentiation because it provides material for the definitive periodontium)

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



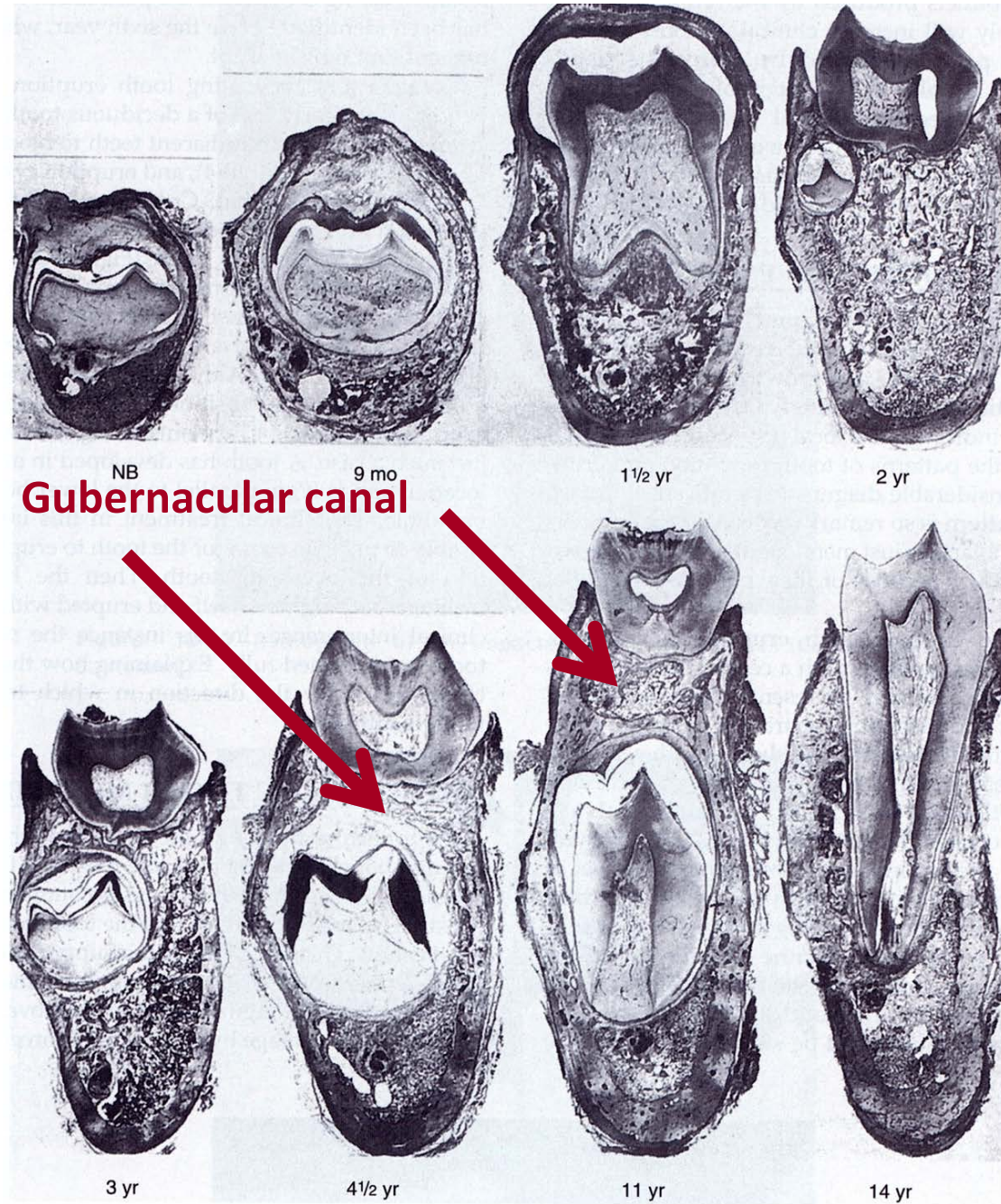


Figure 10-22—cont'd B, Buccolingual sections through the deciduous first molar and permanent first premolar of the mandible at representative stages of develop-

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

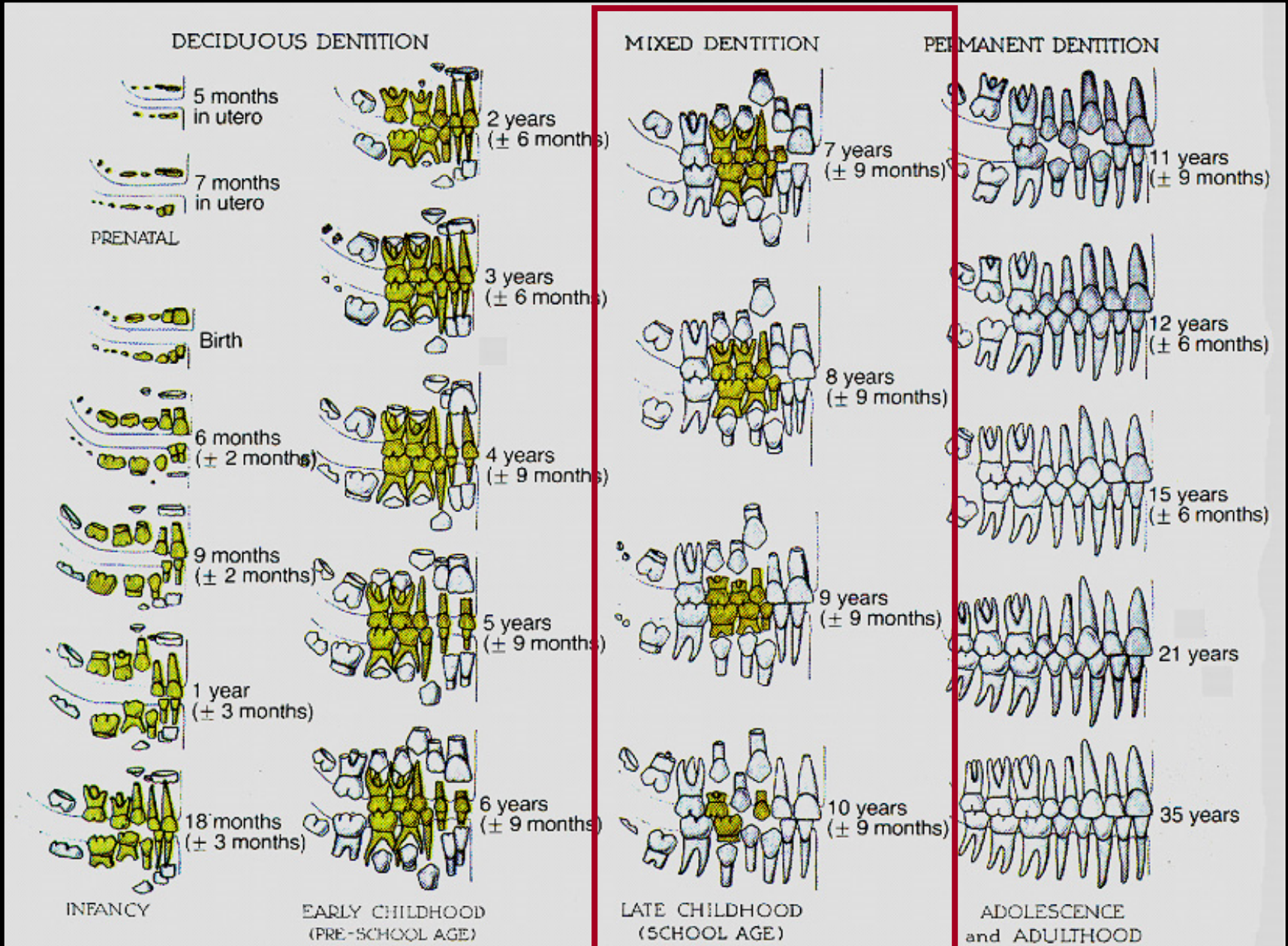
Mixed dentition period - starts **by eruption of the first permanent molar (M_1)** and ends **by exfoliation of the second temporary molar (m_2)**

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

Exfoliation (shedding) of deciduous teeth recapitulate their eruption

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

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

Macrodonia

Microdonia

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

Dens parapremolaris

Dens paramolaris

Dens distomolaris

Dentes prelactales (dentes natales)

*diferenc. dg.: **dentitio precox***



b) Hypodontia

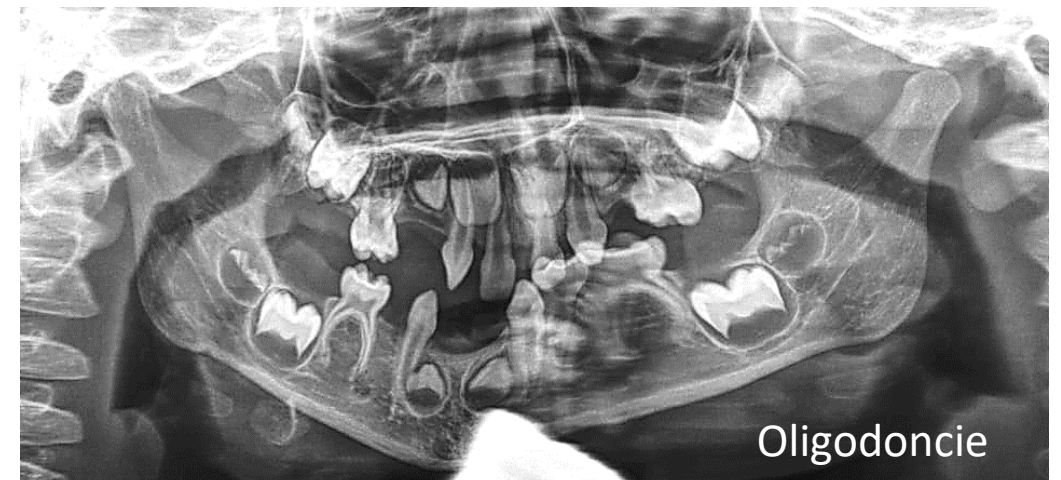
number of lacking teeth is lesser than 6 - most often M_3 , I_2 , P_2 (lower jaw)

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



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)



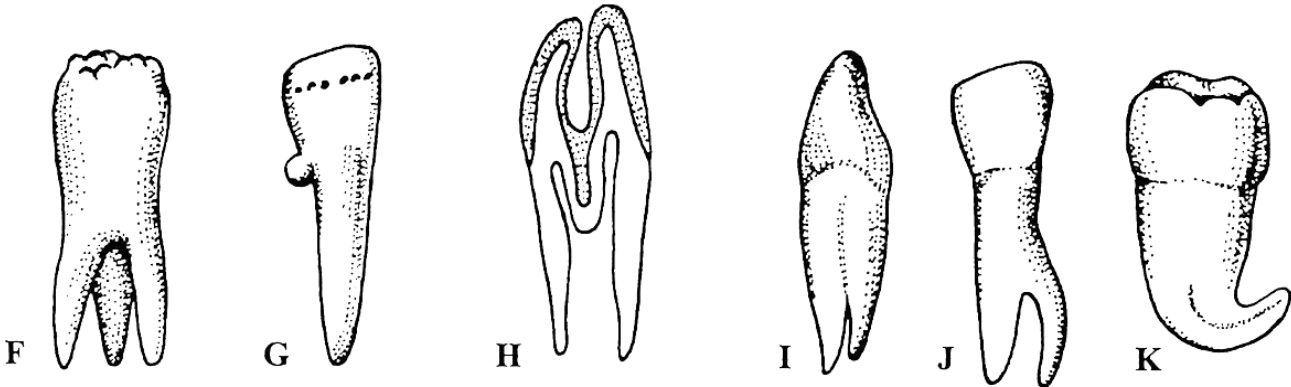
Anomalies of tooth shape

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

Macrodontial vs. Microdontia

Isolated

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

sypphilis 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

hereditary base /described cca 15 various types/

3 forms: **hypoplastic, hypomaturating and hypomineralizing**

hypomineralizing form: thickness of the enamel is normal, but is very soft and crumbled, and soon disappears due the natural attrition

the enamel can also be removed with sharp objects

results from failure to calcify prisms (enamel rods)

sensitivity to cold and heat

1: 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