University of Medicine and Pharmacy "V.Babeș" Timișoara
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Odontogenesis
DYNAMIC DEVELOPMENT OF OCCLUSAL RELATIONS
Deciduous and permanent teeth during growth: morphology, structure, function

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Odontogenesis takes place in several phases, as follows:

- proliferative growth;
- calcification;
- tooth eruption.

Proliferation

The proliferation begins in week 6 of i.n.:

- basal cells from the lining stomodeumului multiply, invaginate into ***maxillary buds***, like a epithelial blade called basal common blade or primary epithelial blade;

- it duplicates in the second month in primary dental blade and vestibular blade(secondary epithelial);

- epithelial cells from the deep portion of the primary dental blade multiply into 20 zones forming ***the dental buds of the 20 primary teeth.***

Proliferation

- is formed ***the permanent buds of the molars*** (at the third molars, bud appears only four years after the birth);

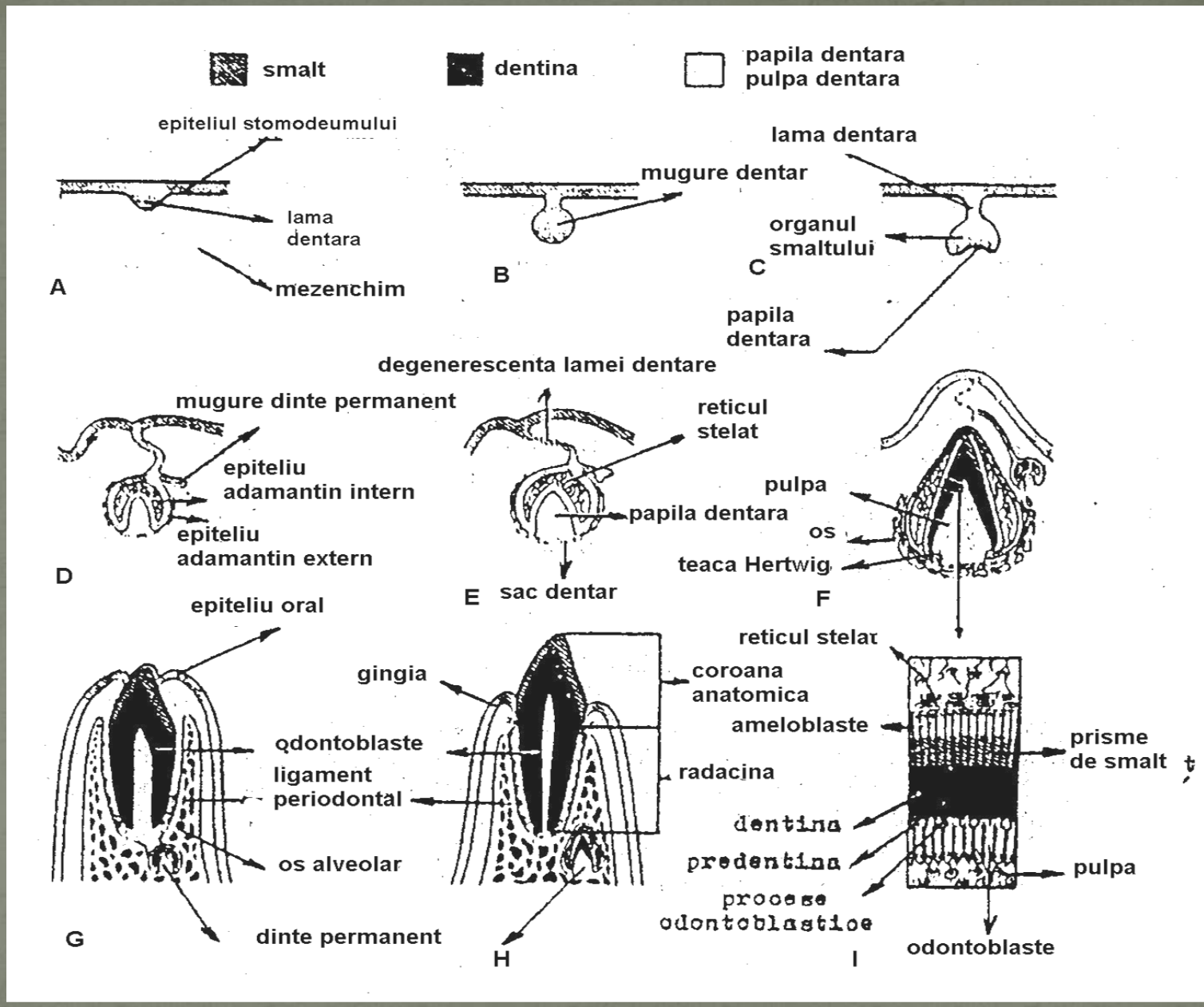
- all through the proliferation of epithelial cells are formed other ***20 buds*** that will form permanent teeth *(8 incisors, 4 canines, 8 premolars)* → the buds for the first permanent molars are formed in the 4th month i.u. → over 15 months (from the 4^{th} month i.u. until 10th month e.u.) is formed: incisors (central and lateral), canines, premolars (first and second).

Histodifferentiation

Phase occurs "capsule" or "cup", which is followed by phase "bell".

In this step :

- *enamel formation occurs;*
- *dentin formation occurs;*
- *dental root formation occurs;*
- *periodontal formation occurs;*
- *gubernaculumul dentis formation occurs.*


smalt
dentina
papila dentara
pulpa dentara
epiteliul stomodeumului
lama dentara
mezenchim
A
mugure dentar
B
lama dentara
organul smaltului
C
papila dentara
degenerescenta lamei dentare
mugure dinte permanent
epiteliu adamantin intern
epiteliu adamantin extern
D
reticul stelat
papila dentara
sac dentar
E
pulpa
os
teaca Hertwig
F
epiteliu oral
gingia
odontoblaste
ligament periodontal
os alveolar
dinte permanent
G
coroana anatomica
radacina
H
reticul stelat
ameloblaste
prisme de smalt
dentina
predentina
procese odontoblastice
pulpa
odontoblaste
I

Morphodifferentiation

- emergence of growth centers on the membrane of the dentino-enamel junction, which develops ***a variable number of cusps and tubers;***

- begins with merging cusps zones;

- *determine the shape, volume and form of the occlusal surface.*

Calcification

= Impregnation with anorganic substances of the organic components from the enamel and dentin.

- start in life i.u. and ends during e.u .;
- calcification process begins in the 4th i.u. and ends after the eruption of the second permanent molars, at approximately 12-14 years old, and when wisdom teeth erupt at 20-30 years;
- dentin is mineralized to 65%, up to 96% and the enamel;
- *when the crown is completely calcified → begin the process of eruption.*

Dental root formation

- the periphery of the bell, dental epithelial cells multiplies and invaginate inwards towards the mesenchyme forming ***Hertwig's sheath → will initiate root formation;***

- at first, sheath Hertwig's proliferate horizontally forming the epithelial diaphragm, which keep their place fixed in the bone, indicating the degree to which they will find fully ***developed tooth apex → position remains fixed, while the crown is evolving toward the surface;***

Gubernaculum dentis formation

- gubernaculum dentis is represented by the epithelial cells column who is linking the dental buds of oral mucosa;

- columns epithelial atrophy with time, becoming a cord with important role in dental eruption;

- this cord is a migration guide in the process of tooth eruption.

Post eruptive teeth maturation

- immediately after the eruption, *the tooth is*, in many aspects, *immature* and maturing processes will continue in the coming years;

- *the enamel* is fully formed at the time of the eruption, but its surface *is porous and poorly mineralized;*

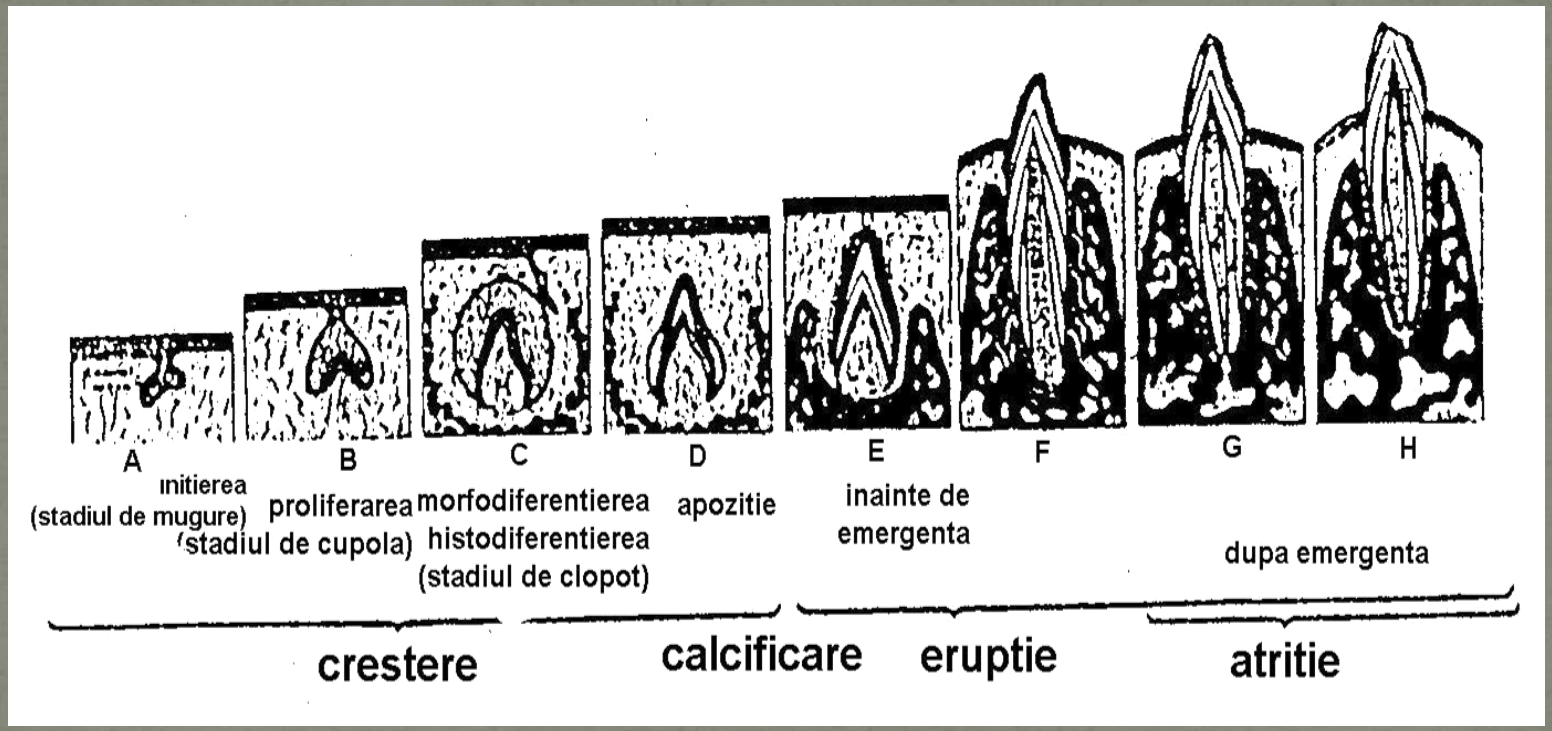
- *dentin formation continues throughout life*. At the time of the eruption, dentin is thin, and the dentinal tubules are very wide. Dentinogenesis will take place in the pulp chamber walls that become thicker and less penetrable, thereby increasing resistance to dentine caries process;

Post eruptive teeth maturation

- in the moment of the eruption, *the cementum* is still thin, and *periodontal ligament fibers* consist of relatively few and disorganized. After completing eruption, the production of cement continues and the fibers become more numerous, reorganizing the link between the tooth and the alveolar bone;

- the formation of the apical portion of the root will continue in the coming years.

The life cycle of a tooth

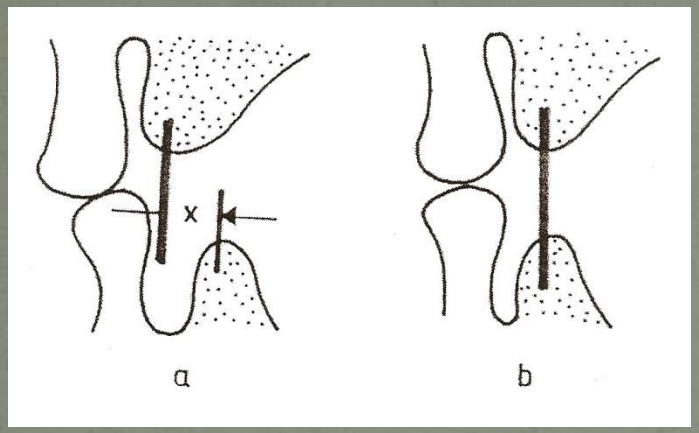


DYNAMIC DEVELOPMENT OF OCCLUSAL RELATIONS

In their evolution, dental arches presents three major periods:

- preeruptive period - right after birth;
- primary teeth eruption period - from 6-30 months;
- functional activity period - between 30 months-6 years.

Preeruptive period



- After birth → maxillary prognatism (80% of cases)

X = 6 -11 mmm

Breast feeding → protrusion and retrusion movements

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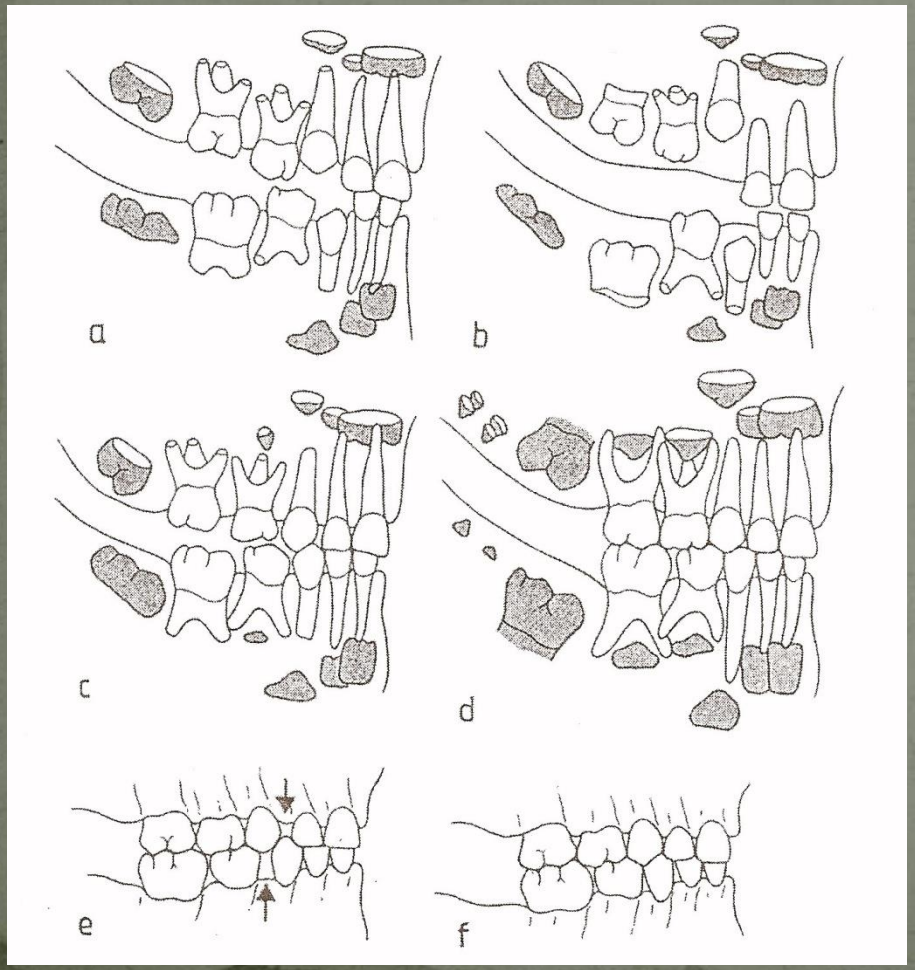
First forwarding of the mandible

Eruption and formation period



Phase formation and training of primary dental arches:

a. The eruption of incisors;

b. The eruption of the first molars;

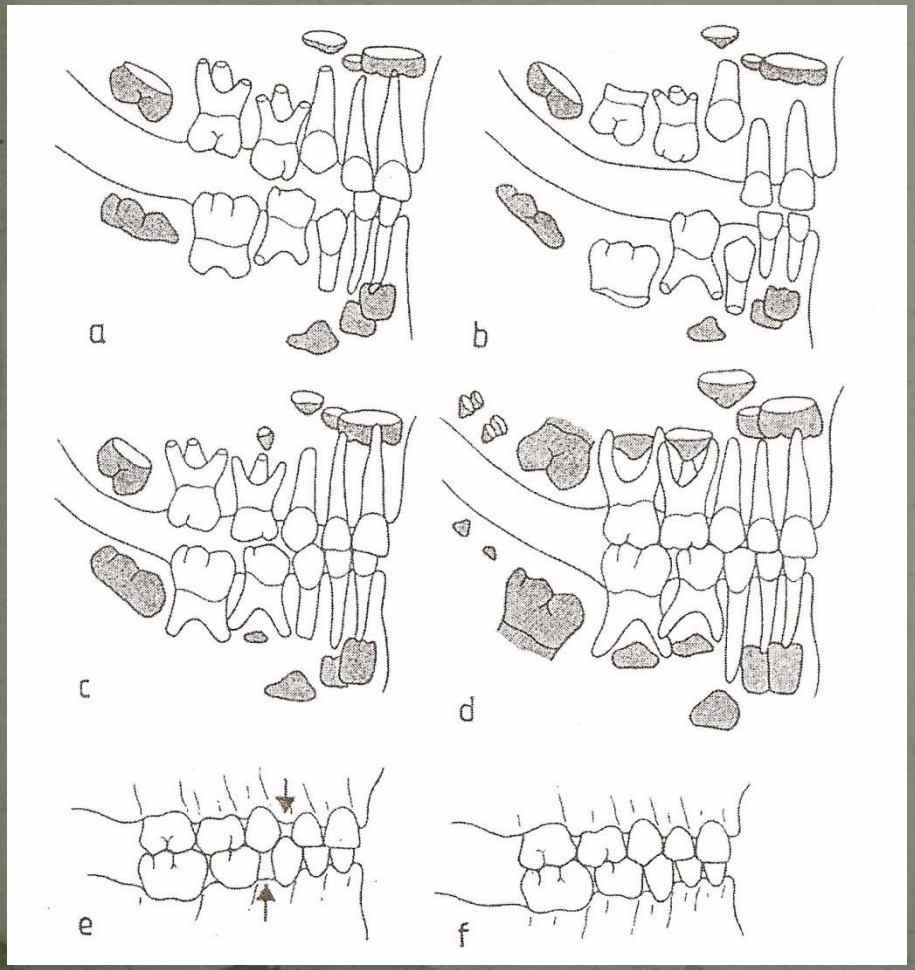
c. The eruption of canines;

d. primary arches complete;

e. simian space;

f. without simian spaces.

Eruption and formation period



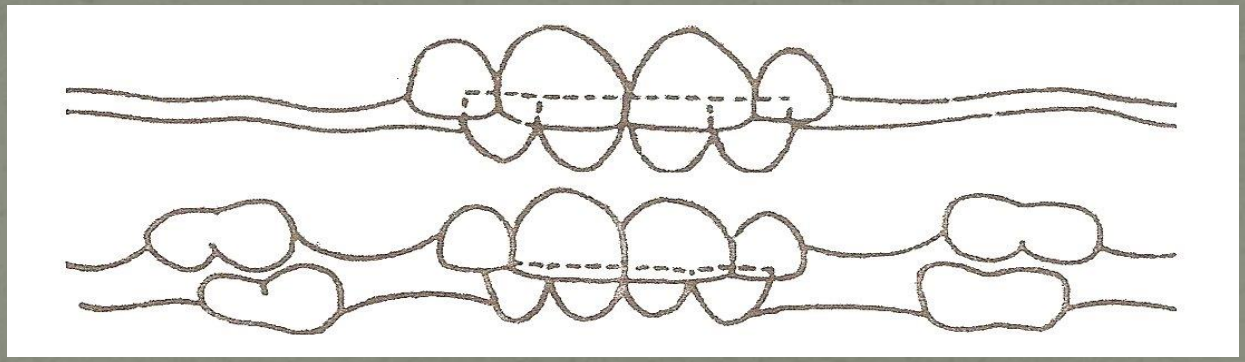
Two types of primary dental arches:

Dental archesType I - with Simian spaces;

Dental arches Type II - without Simian spaces.

Eruption and formation period

The occlusion relations between the two primary arches → vertical dimension of the lower floor = ***first physiological uplift of the occlusion*** - which remains relatively constant until the appearance of permanent molars.



Functional activity period

Is divided into two stages:

- primary phase morphology (2½-4 years);
- secondary stage morphology (4-6 years).

Primary stage morphology

Features:

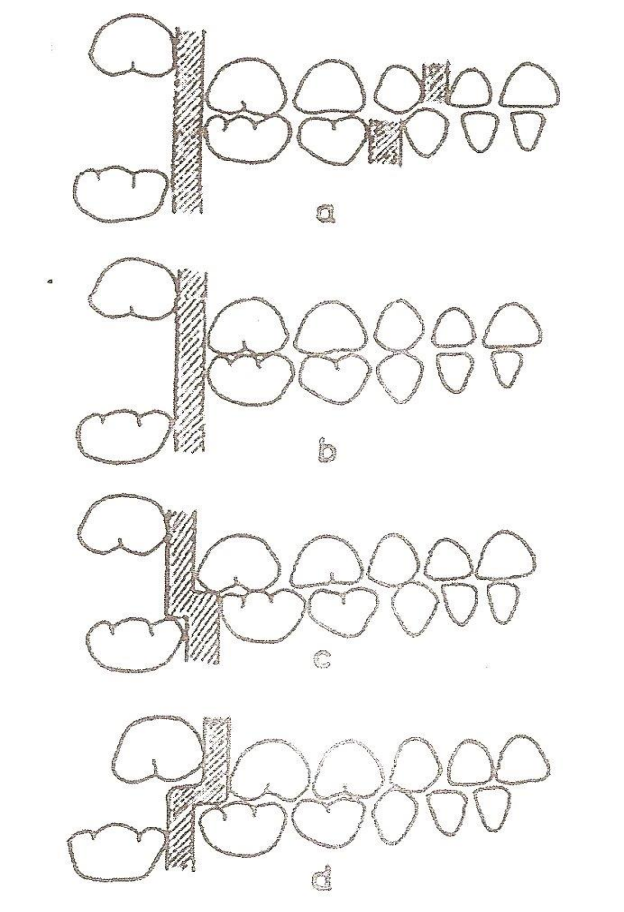
- arches form – wide ”U” shaped;
- the upper arch circumscribe lower arch;
- occlusion curves are smoothed;
- upper canine teeth are placed between canine and lower first molar ratio → neutral;
- each tooth occlude with two antagonists teeth (except for the lower central incisors and molars mates superiors);

Primary stage morphology

Features:

- The mesiodistal relation between the distal surfaces of the upper and lower second primary molars = ***terminal plane***;

Primary stage morphology

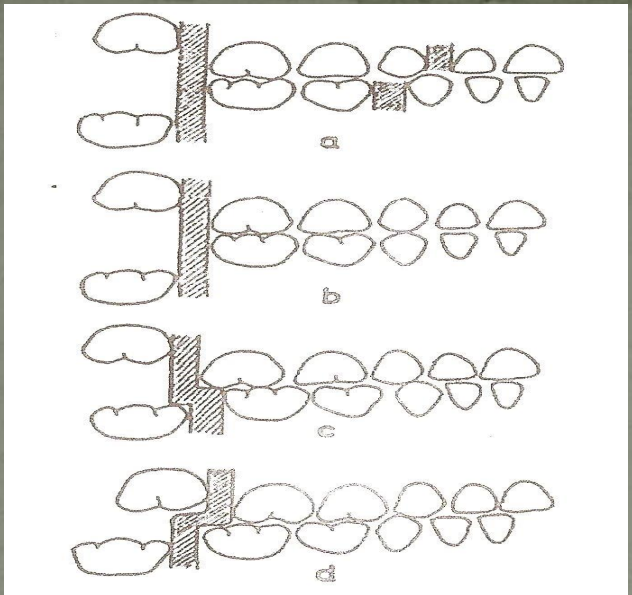


Terminal plane:

a, b. Flush terminal plane;

c. Mesial step terminal plane;

d. Distal step terminal plane.



Terminal plane

Flush terminal plane = first permanent molars establish occlusal relations cusp to cusp = unstable relation → mesial or distal end sliding jaw.

Mesial step terminal plane → first permanent molars will produce normal cuspal interdigitation, by the eruption of the lower first permanent molar in mesial position.

Distal step terminal plane → first permanent molars will produce distal occlusal relations.

Primary stage morphology

About 70% of children have spaces at the front

→→→ permanent successors can defeat more voluminous space deficiency.

Primary stage morphology

- if there are ***no spaces*** between the primary teeth → there is 70% chance of crowding on permanent teeth;

- the spaces ***< 3 mm*** → possibility of crowding = 50%;

- and when spaces ***> 6mm*** → chances are very low occurrence of crowding.

Secondary stage morphology

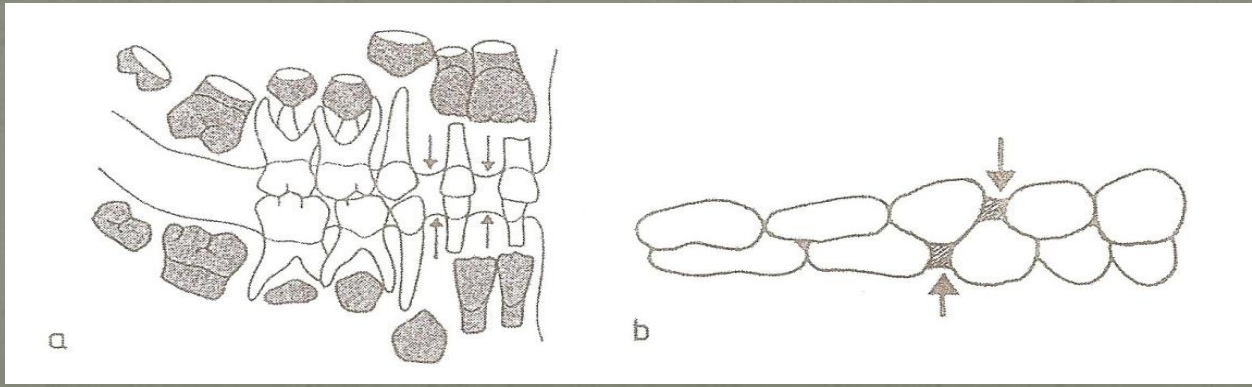
- 4-6 years;
- functions involved in conducting a series of changes of primary morphology parameters:

- Appears the physiological attrition in all temporary teeth faces → → second forwarding of the mandible.

Secondary stage morphology

Changes in the parameters of primary morphology:

- Jaws are growing → between temporary teeth spacing appear (diastemas and spaces) → normal alignment of permanent teeth.



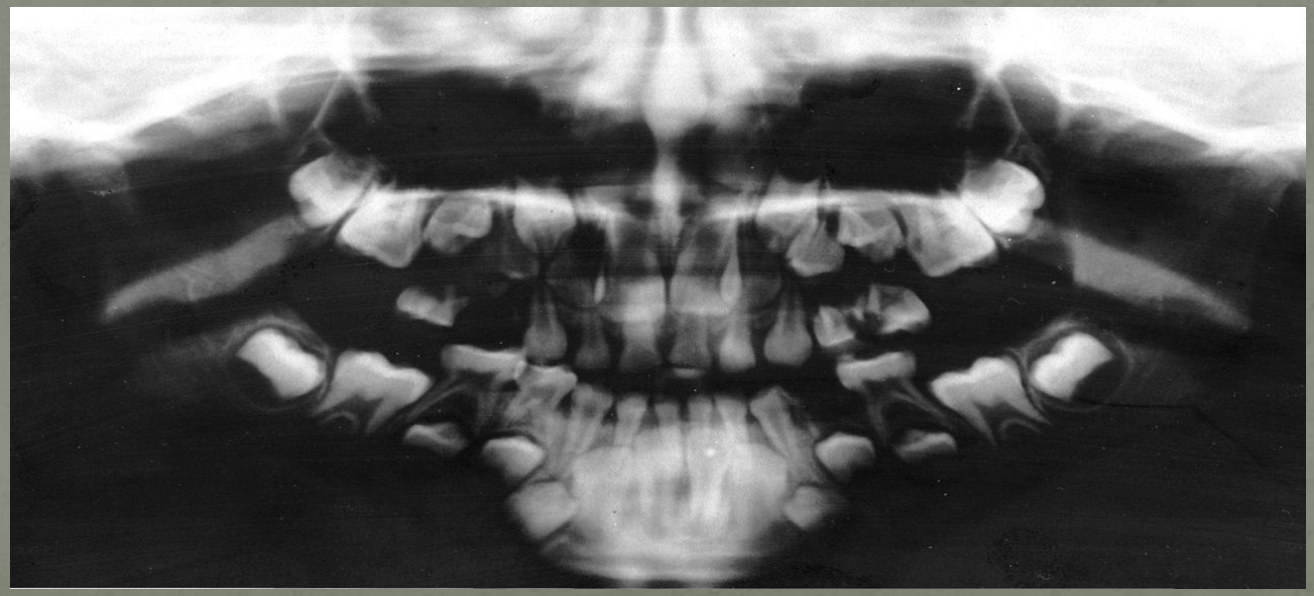
Secondary stage morphology

Changes in the parameters of primary morphology:

- stronger growth and development of the mandible in the sagittal way → emergence of a space between the front edge of the branch and second primary molar = retromolar field → provide the necessary premises for the first permanent molar eruption.

The dental arches during mixed dentition

- the first permanent molar emergence → → the beginning of the mixed dentition onset of → → ***the second physiological uplift of the occlusion.***



The dental arches during mixed dentition

- between mesio-distal diameters of the temporary and permanent incisors occurs significant differences:

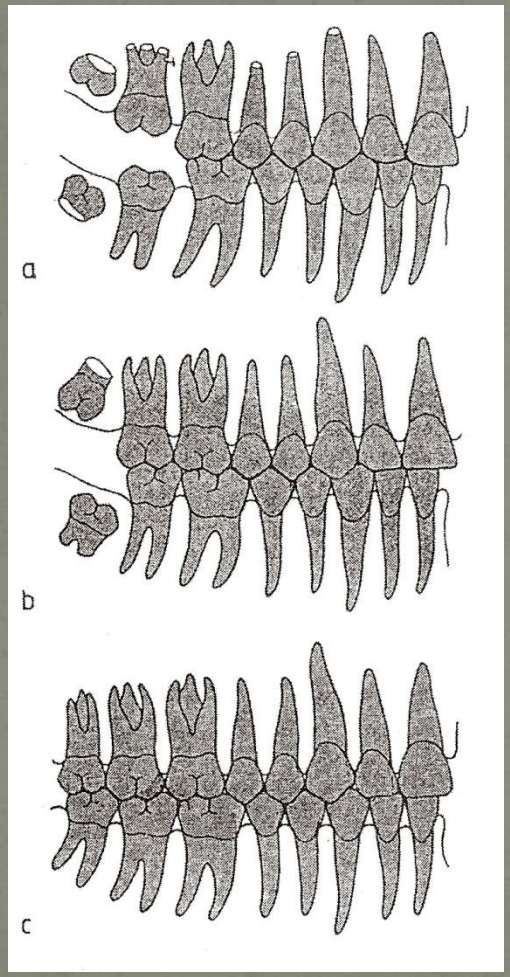
- 7.6 mm from the upper arch;
- 6 mm at lower arch.

The dental arches during mixed dentition

- while the eruption of permanent teeth → ***resorption phenomenon*** of the temporary teeth;

- after 6 years of age, changes occur in the dental arch perimeter = additional interdental spaces → harmonious alignment of permanent teeth.

The dental arches during permanent dentition



Three periods:

- ***"Stable young adult arch "*** = 6 y;
- ***"Young adult arch"*** = period of the second permanent molar;
- ***"Full arch of the adult"*** = reaching the final size of the arches.

The dental arches during permanent dentition

Permanent natural arches, harmoniously developed, has a number of parameters:

- corresponding axial positions;
- presence of interproximal contact areas around which appear embrasures with a certain symmetry;
- mesial location of each lower tooth below the superior counterpart;

The dental arches during permanent dentition

Permanent natural arches, harmoniously developed, has a number of parameters:

- the existence of two antagonists per unit, except the lower incisor and the upper third molar;
- the presence of two characteristic occlusion curves (von Spee and Wilson);
- upper arch is wider and longer, it circumscribes total the lower arch.

Permanent teeth during growth

Young permanent teeth = permanent teeth during growth or immature teeth.

- Root apical region has not completed the development (the apex is still open), dental hard tissues in general are incompletely mineralized, ending process only after 2-3 years of their appearance on the arch → ***extremely vulnerable to decay***;

- have an occlusal shape injured (both positive and negative) → accumulation of plaque on their inoperative period (until reaching occlusion plan).

Young permanent teeth

- the most striking peculiarity in these teeth remain the unedified apical region with apex "in the funnel";

- this area with potentially active cell and well vascularized → contributes in a few years to build the apical third of the root and apex closure;

- even when the root has reached its final length, apex remains wide open for about two years.

Young permanent teeth

- these teeth enamel presents an incomplete mineralized layer → → vulnerable to acid attacks →→ using fluoride during this period is very beneficial;

Young permanent teeth

- large volume of the pulp chamber;

- pulp horns near the cusps;

- increased dentin permeability.

↓↓↓↓↓↓

pulp impaired in deep cavities is very fast

Young permanent teeth

- defense capabilities of the pulp must be deployed → pulp vitality preservation techniques (direct pulp capping or pulpotomy).

We must take into account the morpho-clinical peculiarities of the young permanent teeth → decisive influence on therapeutic procedures adapted at these ages.

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