DIFFERENCES BETWEEN PRIMARY AND PERMANENT DENTITION

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INTRODUCTION

- A person 70 years old will have spent 91% of his/her life chewing on permanent teeth, but only 6% of his/her chewing career with the deciduous dentition.•
- Deciduous teeth play a very important role in the proper alignment, spacing, and occlusion of the permanent teeth.

MORPHOLOGICAL DIFFERENCES

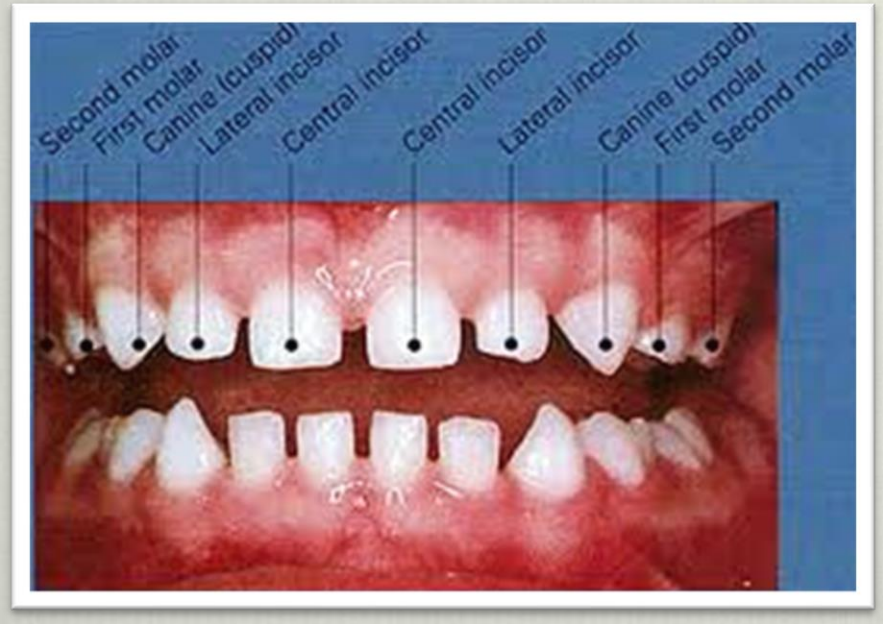
The word deciduous comes from a Latin word meaning to fall off or shed(like leaves from a deciduous tree) .

Toooth Number and size:

The most obivous difference between primary and permanent dentition is the number of teeth

20

I 2/2,C 1/1,M 2/2



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I 2/2 ,C 1/1, PM2/2 ,M3/3

TOOTH SIZE

Primary teeth are smaller than crowns of their successor, only with few exceptions.

CROWN

ANTERIOR TEETH:

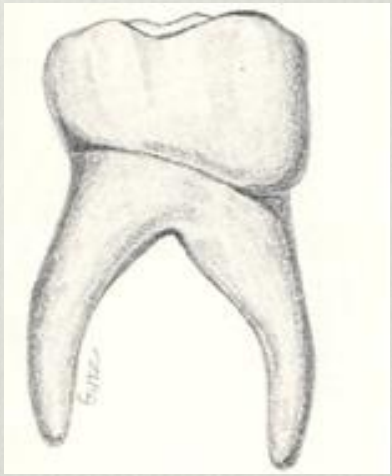
- Primary teeth resemble permanent teeth in several ways.
- Usually there are no depressions or perikymata on the labial surface of the crown of the incisors, these sufaces are smooth.

- The cingulae are prominent or seem to bulge and occupy about 1/3rd of the cervicoincisal length lingually.

- There are no mammelons on the incisal edges of the deciduous teeth

POSTERIOR TEETH:

- Primary molars bear no resembles to the premolars that will succeed them.
- Second primary molar crown resembles the adjacent first permanent crown.
- On the posterior teeth the cervical ridge is prominent mesially (it is easy to distinguish right from left).



WIDTH:

- Crowns of primary teeth are shorter incisocervically than mesiodistally and have a short ,thick set appearance.

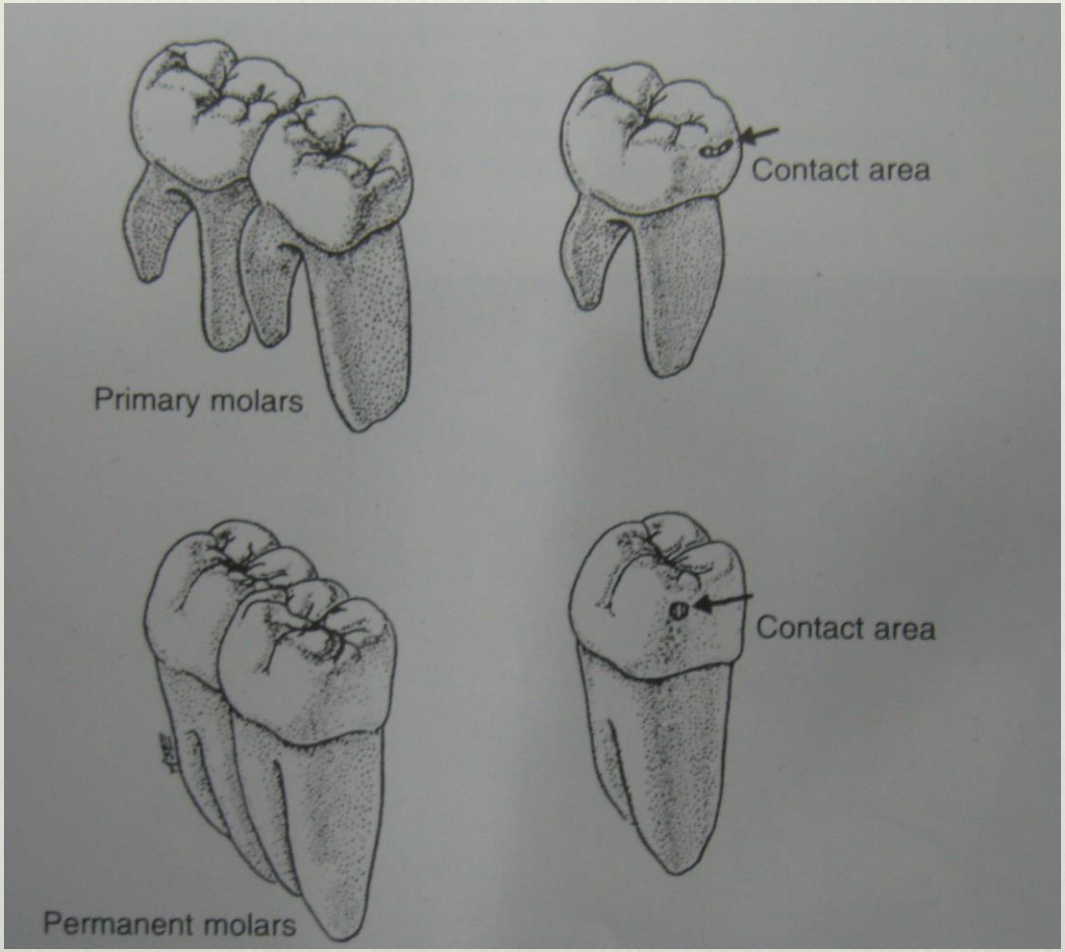
CONTOUR:

- Primary teeth have greater contour than permanent teeth, especially at the cervical portion of the crown.

CONTACT AREAS:

- Primary molars have flattened approximal surfaces results in a contact line.

CONTACT AREA



CUSP HEIGHT:

- In newly erupted deciduous teeth ,the cusps tends to be more pointed & short and occlusal surfaces are shallow.

- Permanent molars and premolar have steeper cusps than their primary counterparts & interdigitation is more flexible with primary molars than with permanent ones.

PULP

- Pulp chamber larger in relation to crown size.
- Pulp horns are high & closer to the occlusal surface.
- Because the primary molars are small and have large pulps,the bulk and depth of restorations are limited.

ROOTS

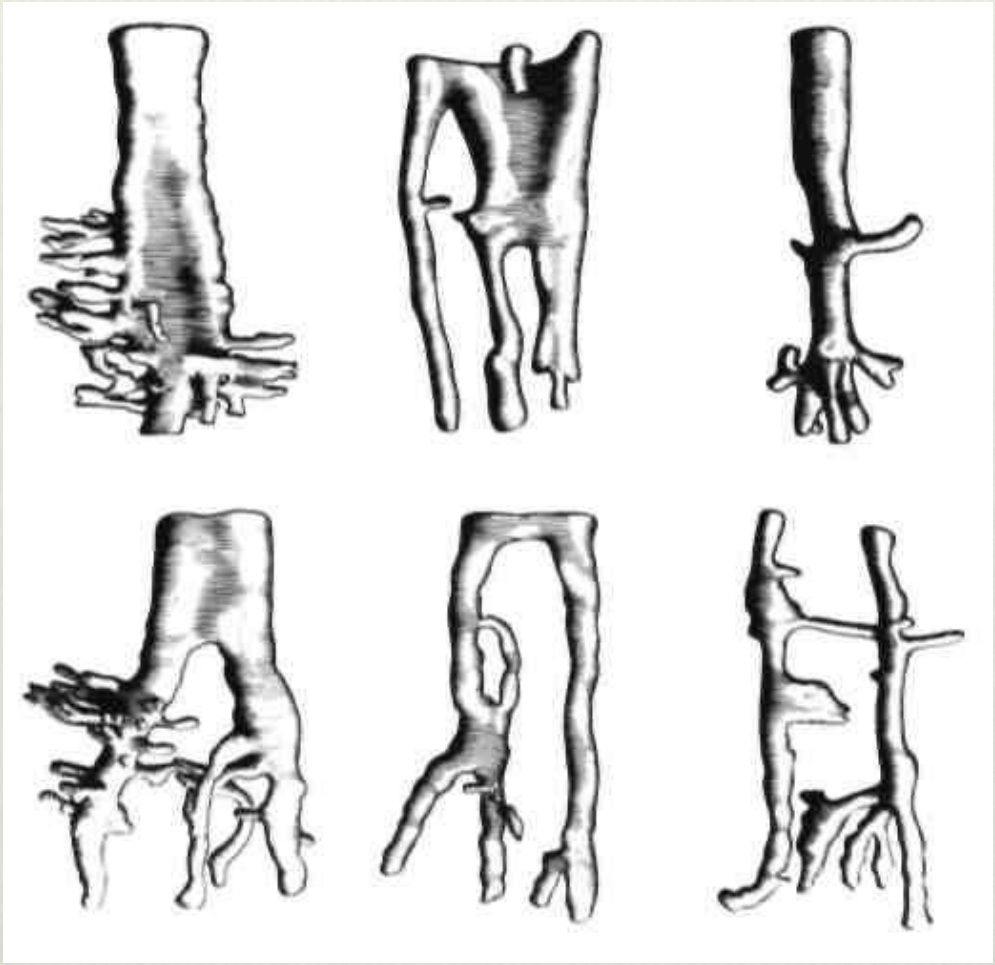
ROOTS

- Divergent and flat curved roots of the primary molars permit the development of the underlying premolars.
- The primary second molar roots are spread more widely than the first deciduous molar(opposite of the permanent molars).
- The root furcation is near the crown and there is little if any root trunk in primary teeth

- Primary roots have an enlarged apical foramen, in contrast to the foramen of permanent ,which is constricted.
- The resultant reduced blood supply in mature permanent teeth favours a calcific response and healing by calcific scarring.

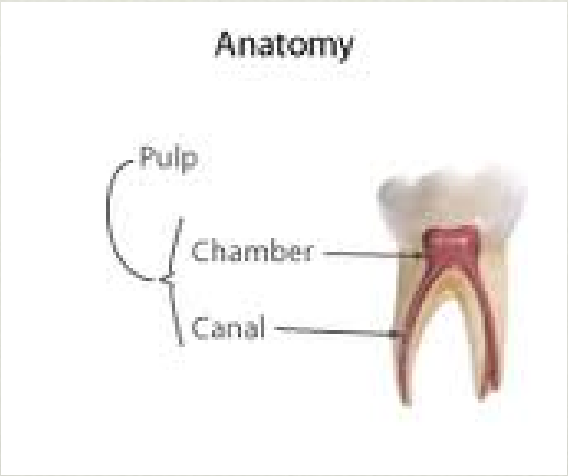
ROOT CANAL

- The root canal of deciduous teeth are very fine.
- Flat ribbon like root canal of the primary tooth is in sharp contrast to the oval, tube like root canal of the permanent tooth.
- Significant development difference occurs in the root canal of the primary molars, the root fills in unevenly with secondary dentin, which leaves calcified bridges



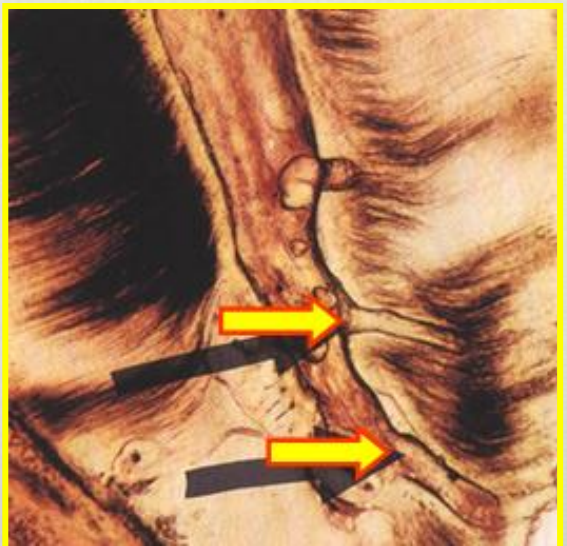
CLINICAL SIGNIFICANCE:

- The radicular pulp of primary molar follows a thin, tortuous & branching path as shown by Hibbard &Ireland(1957).
- Multiple branching of primary pulp makes conventional endodontic procedure considerably more difficult than in permanent teeth.



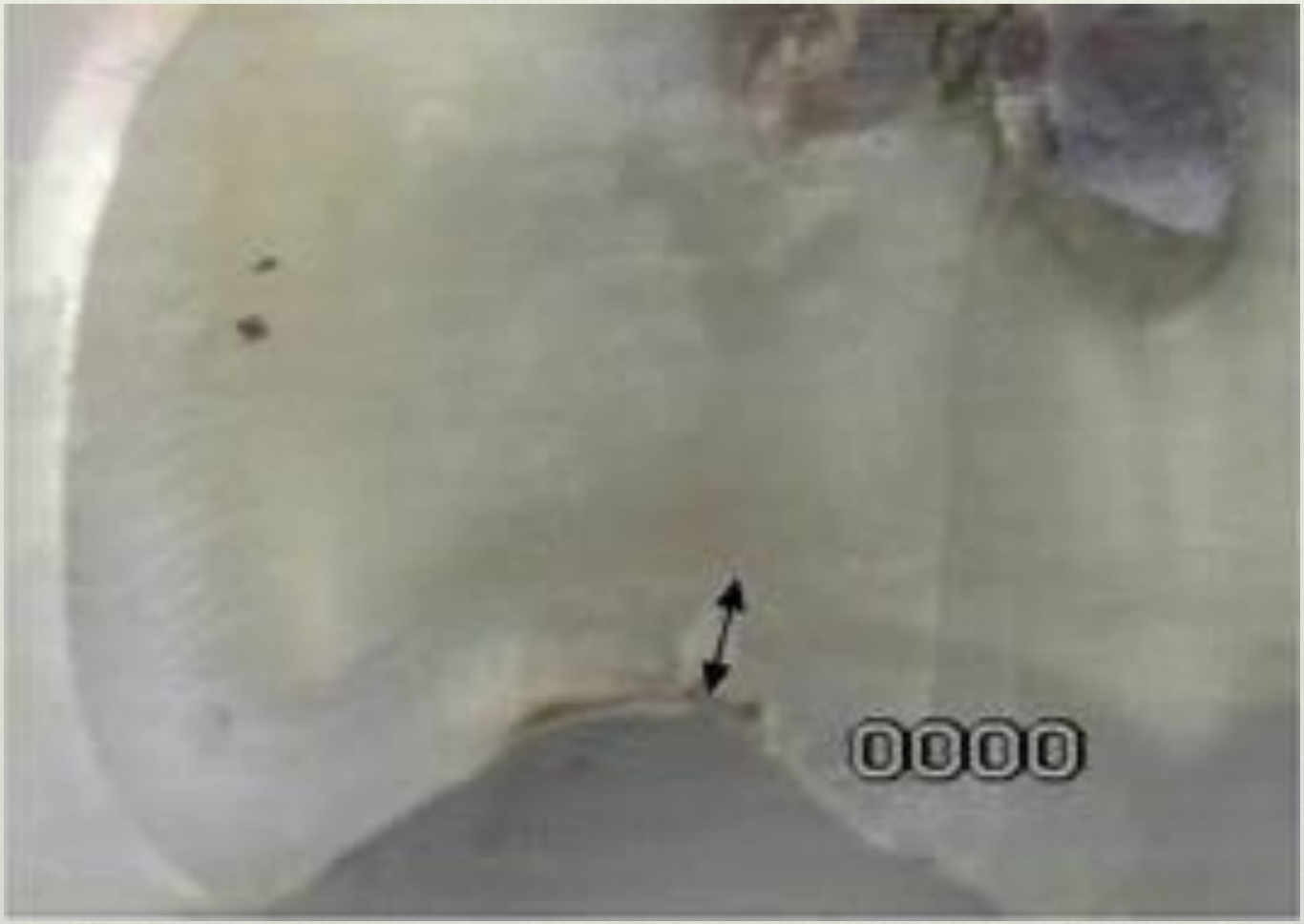
ACCESSARY CANALS

- In primary teeth accessory canals are more in interradicular region where as in permanent teeth more in apical region.
- Accessary canals with the porous pulpal floor seen in non vital primary molars may account for the leakage of inflammaory products from pulp chamber to the interradicular area.



HISTOLOGICL DIFFERENCES

ENAMEL



ENAMEL

Permanent teeth

- Thickness is app. 1-2mm.
- inorganic components between 92-96%
- Organic component i.e protein is 0.15%

Primary teeth

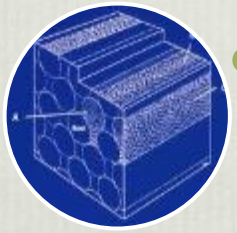
- Thickness is app.0.5-1mm
- primary teeth is between 92-93%.
- app. 0.22% protein

Composition of enamel

Mineral	Permanent	Primary
Calcium	36.4	35.0
Phosphorous	17.4	18.5
Carbondioxide	2.7	2.7
Ca/P	2.10	1.87

ENAMEL ROD

3.84 um (60.73) to 4.34 um (60.95) um for the permanent teeth.



The mean rod head diameter varies from 3.22 um (60.45) to 3.47 um (60.48) for the primary teeth

ENAMEL RODS

- Mean number of rods (per square mm) to permanent and deciduous teeth in the different regions

	Outer surface	Near DEJ
Deciduous teeth	14.149 (+/- 1.009)	15.244 (+/- .648)
Permanent teeth	13.585 (+/- .600)	14.010 (+/- .391)

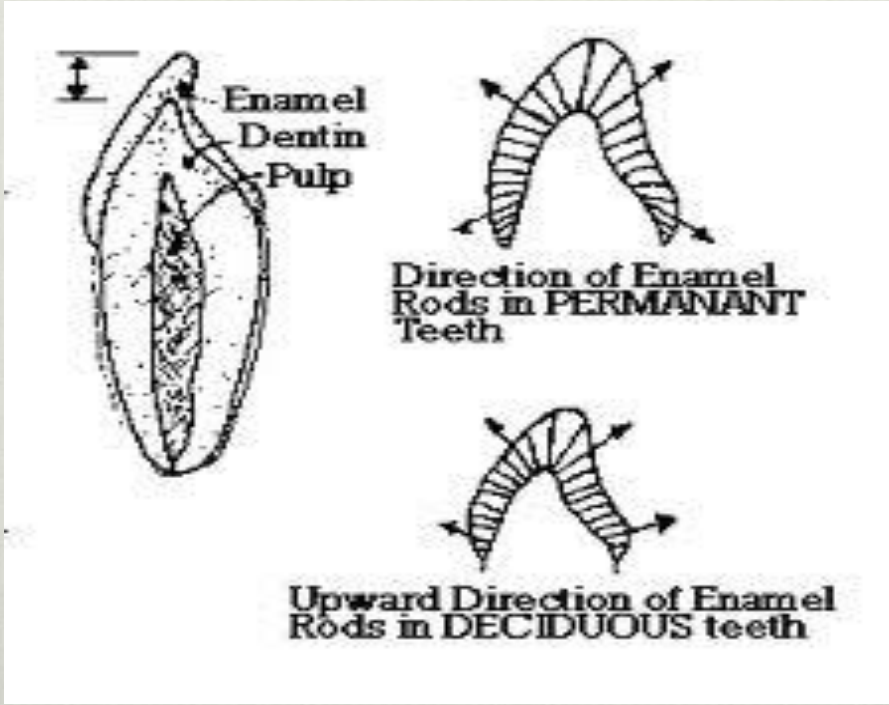
- Numerical density of enamel rods : Higher in deciduous teeth than that in permanent teeth and increased from superficial surface to deep layer nearest the junction.

Low et al. (2006, 2007) observed larger and coarser crystals in primary teeth (185 nm) when compared to the permanent teeth (94 nm).

Kerebel et al. (1979) described that the enamel crystallites thickness are 26.3 nm in permanent teeth and 16.0 nm in primary teeth

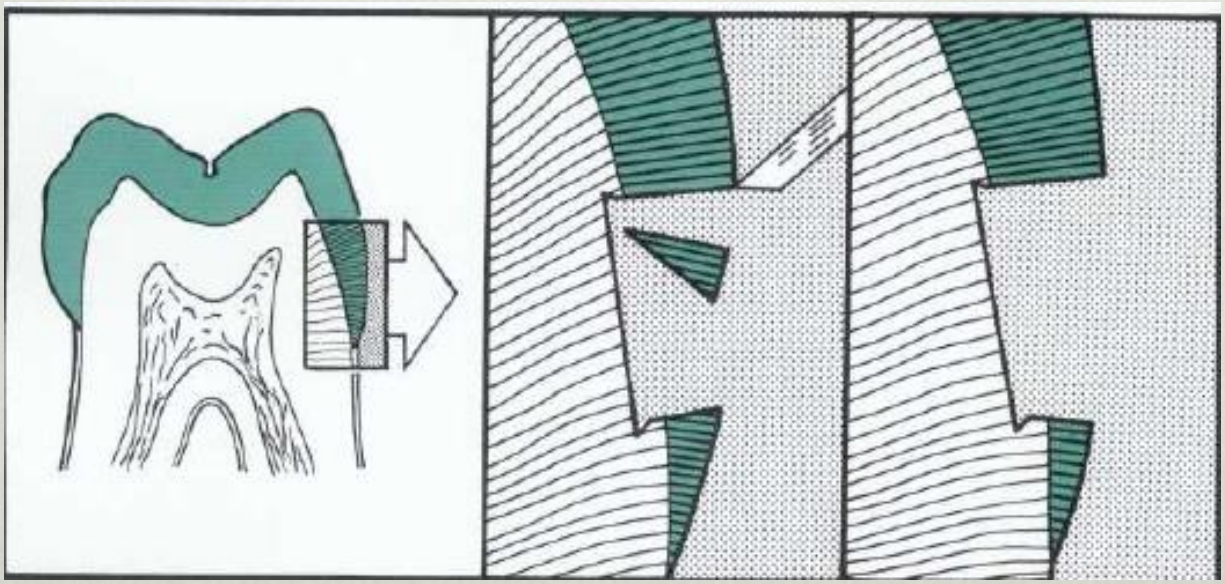
ENAMEL ROD DIRECTION

- In primary teeth the inclination of enamel rods in the gingival thirds is occulsal.
- In permanent teeth the enamel rods incline horizontally or apically in the gingival third.



CLINICAL SIGNIFICANCE:

This requires the use of gingival marginal trimmer in permanent teeth to ensure that there will be no unsupported enamel rods.

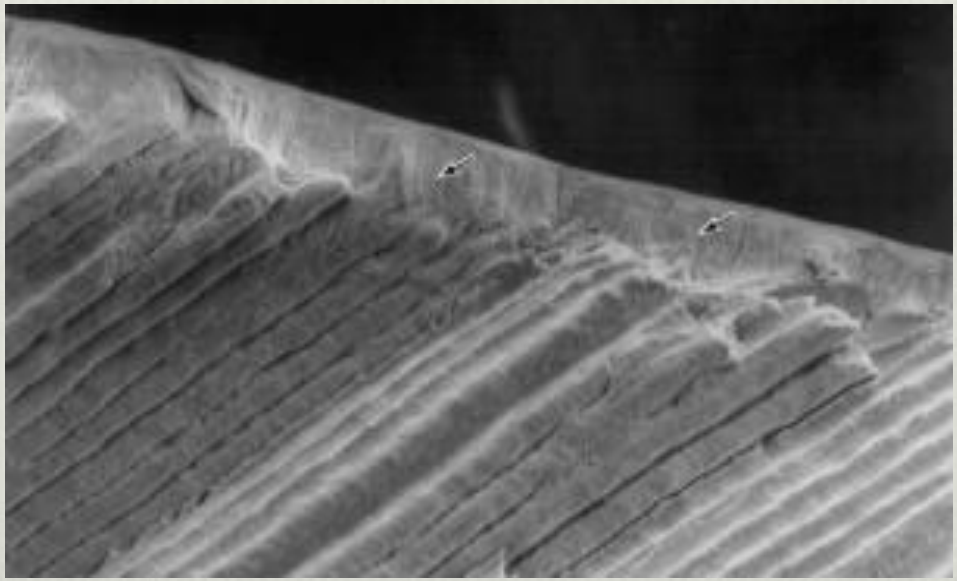


APRISMATIC LAYER

(Fava et al., 1999, 1997) have documented the prismless enamel layer, in which the hydroxyapatite crystals are disposed parallel to each other and perpendicular to the enamel surface on teeth.

APRISMATIC ZONE

- More than 60% of the primary teeth had an aprismatic surface zone of 16-45um thick, while half of the permanent teeth had an aprismatic zone of <5um (Whittaker 1982)

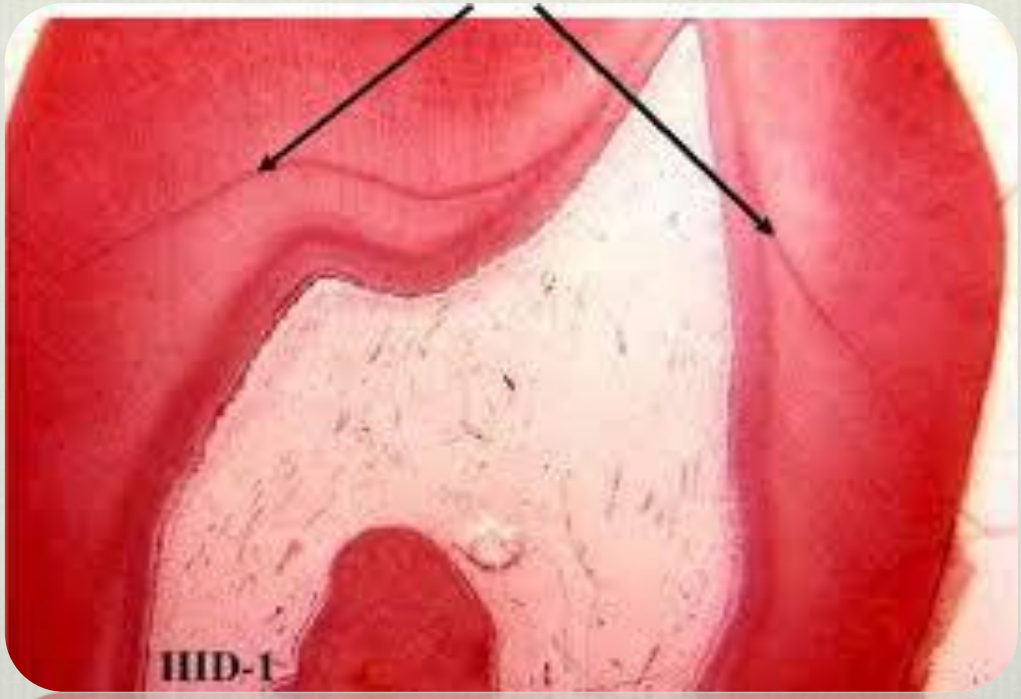


CLINICAL SIGNIFICANCE OF APRISMATIC ZONE:

- Compared to etched permanent enamel, bond strength of resins to etched primary enamel are lower.
- Because of the presence of prismless layer displaying a uniform crystalline orientation but lacking prism structure.
- Some authors have suggested the prolonging of the primary enamel phosphoric acid-etching time in restorative procedures in order to obtain the dissolution of the prismless layer (Bozalis et al., 1979; Hosoya, 1991)

NEONATAL LINE

- Neonatal line is found in primary teeth is a hypomineralised strcture and is a growth phase in the enamel and is seen as a biological landmark of birth.(Schour 1936)



DENTIN

- Primary dentin may differ from permanent dentin due to the different degree of mineralization found in the two structure.
- Hirayama et al reported that peritubular dentin found in primary teeth was 2-5 times thicker than found in permanent dentin.
- Concentrations of calcium and phosphorus in both peritubular and intertubular dentin are lower in primary teeth than in permanent teeth.

DENTINAL TUBULES

- The numerical tubule density in primary teeth is greater than that of permanent dentin.
- Tubule diameter &tubule numerical density increases fron DEJ towards pulp with peritubular dentin width displaying inverse trend.

Indian study by N Chowdhary, VV Subba Reddy , permanent teeth S shaped curvature of dentinal tubules is due to crowding of odontoblasts from periphery to the center of the pulp.

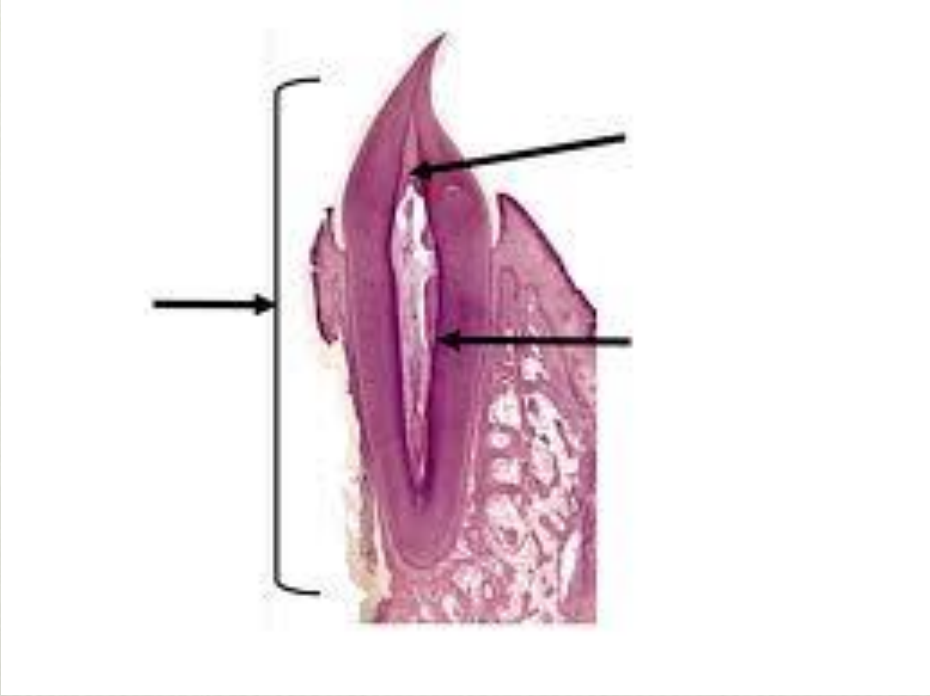
Deciduous teeth dentinal tubules are straight due to difference between the surface area of dentin near the DEJ and that near the pulp

HARDNESS OF DENTIN

- A comparison of the hardness of dentin reveals primary dentin is slightly softer than that of permanent dentin.
- Peripheral and circumpulpal areas are similar in hardness in both dentitions but the central area of root and crown dentin is considerably harder in permanent teeth than in primary teeth.
- Average hardness in primary teeth is 55.4 KHN and in permanent teeth is 69-72 KHN

CELLULAR RESPONSE

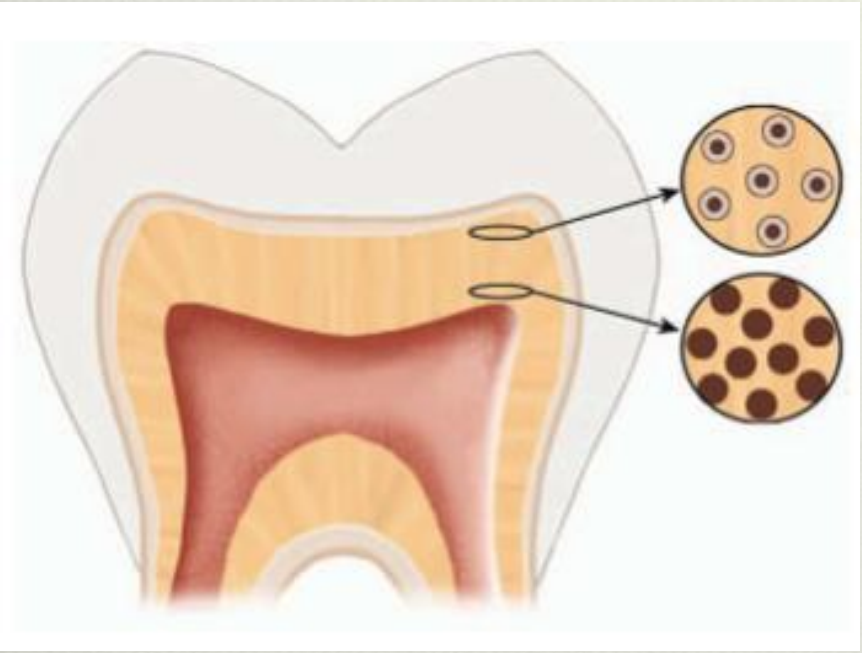
- Incidence of reparative dentin formation beneath carious lesions is more extensive in primary than permanent teeth.



RESIN BONDING

- Primary tooth dentin has larger tubule diameters with peritubular dentin at least 2 times thicker than permanent dentin.
- Peritubular dentin etches rapidly during bonding treatments and leaves the etched intertubular dentin matrix with enlarged tubule lumens.
- Further decreasing the solid dentin available for bonding.

THE PULP-DENTIN COMPLEX—KEY POINTS OF CLINICAL RELEVANCE



- Deep dentin is more porous than superficial dentin in primary and young permanent teeth.
- Sensory innervation to the pulp does not mature until the late stages of root formation
- Young, well-perfused pulps have enormous reparative capacity in the face of injury

PRIMARY PULP

- The average length of time a primary pulp functions in the oral cavity is only about **8.3 years**.
- This amount of time can be divided into three periods :-

- Pulp organ growth-1yrs
- Pulp maturation-3.75yrs
- Pulp regression-3.5yrs

PULP OF PERMANENT TEETH

- Pulp of the permanent teeth undergoes development for about 12 years, 4 months.
  - Crown formation and calcification 5yrs 5month
  - Crown completion to eruption – 3yrs 6months
  - Eruption till root completion-3yrs 11 months
- The maxillary arches require slightly longer time to complete each process of development than do the mandibular arches.

- **Fox and Healy** concluded that, histologically, no structural difference exist between primary pulp tissue and young permanent pulp tissue with the exception of the presence of a cap – like zone of reticular and collagenous fibers in the primary coronal pulp.

CEMENTUM

- As demonstrated by Furseth, the cementum of primary teeth is very similar to cementum of permanent teeth .
- But primary teeth present a smaller number of incremental lines and have a thinner cementum
- secondary cementum is absent

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CEMENTOENAMEL JUNCTION IN PRIMARY TEETH

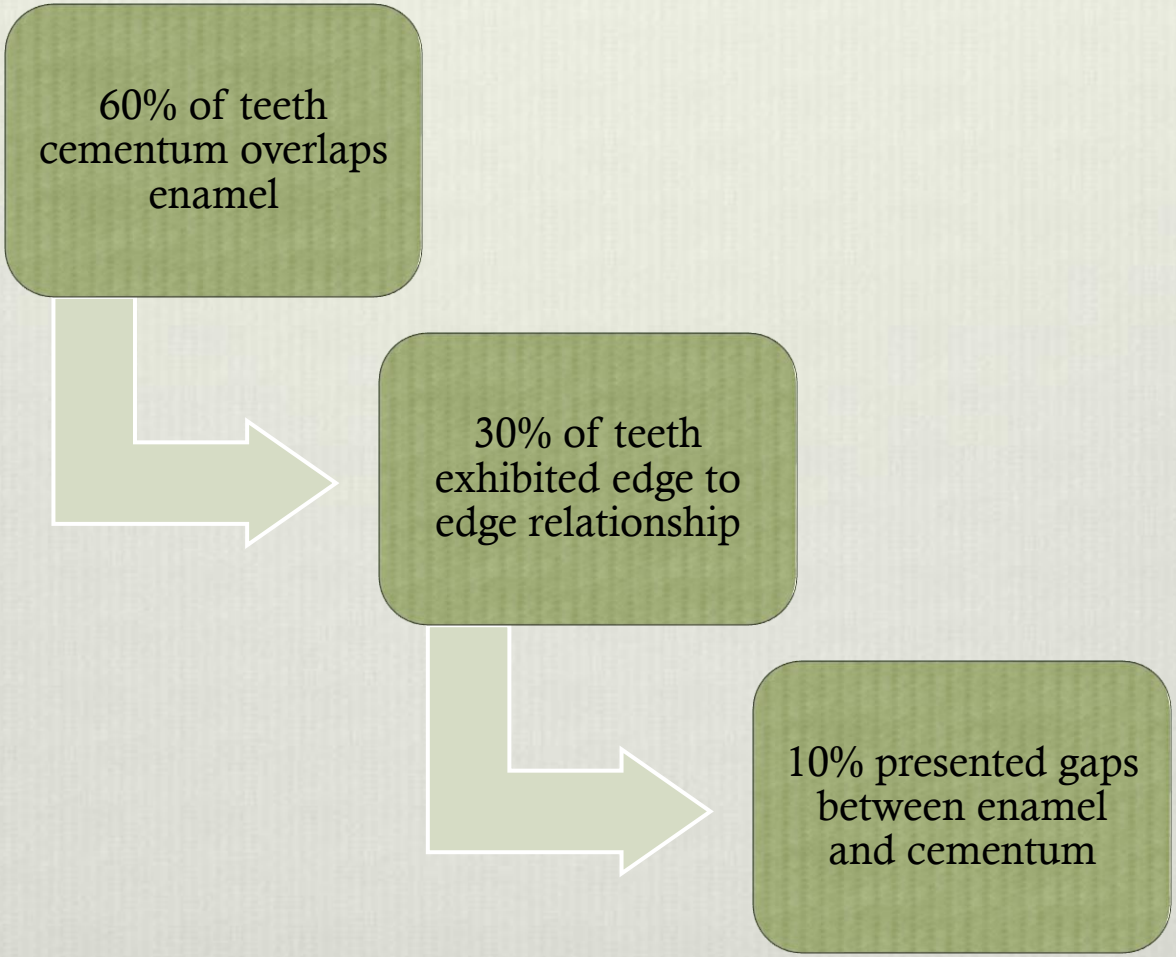
47% of primary teeth presented cementum overlaps enamel

41% of teeth exhibited edge to edge relationship

12% presented gaps between enamel and cementum

- CARVALHO et al

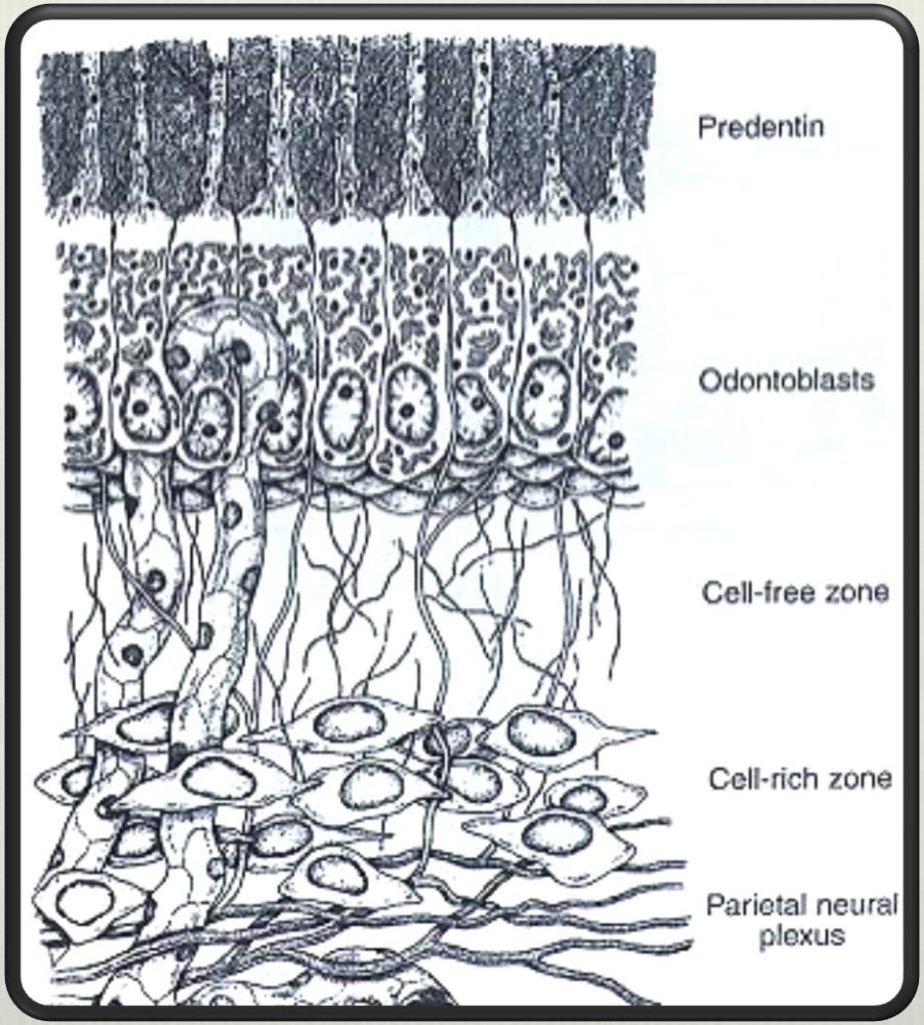
CEMENTOENAMEL JUNCTION IN PERMANNENT TEETH



BLOOD SUPPLY

- Primary teeth with their abundant blood supply demonstrates a more typical inflammatory response than that seen in mature permanent teeth.
- The exaggerated inflammatory response in primary teeth may account for increased internal and external resorption.

NERVE SUPPLY



NERVE SUPPLY

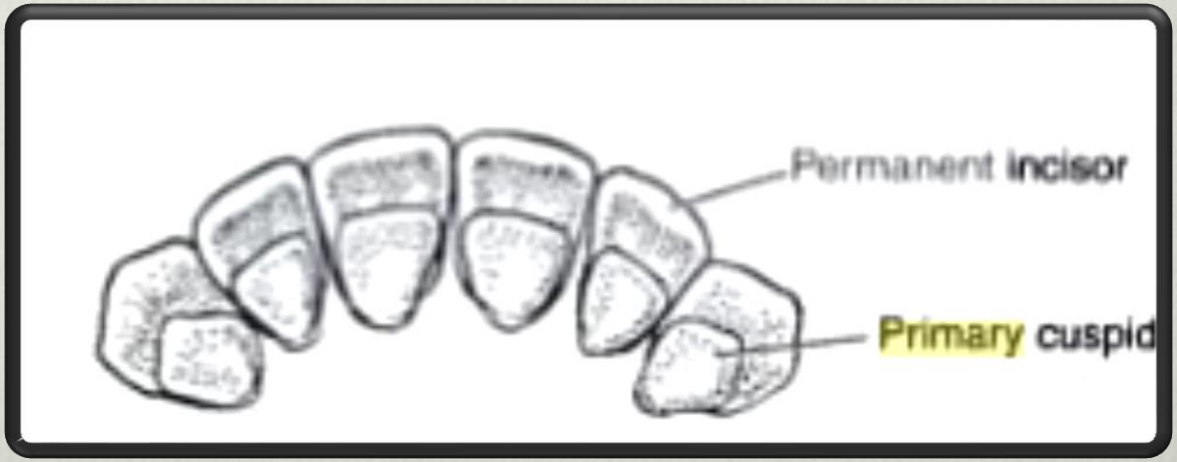
- In permanent teeth ,the nerve fibres terminante mainly among the odontoblasts & even beyond the predentin.
- In primary teeth , free nerve endings terminate among odontoblasts.

CLINICAL SIGNIFICANCE:

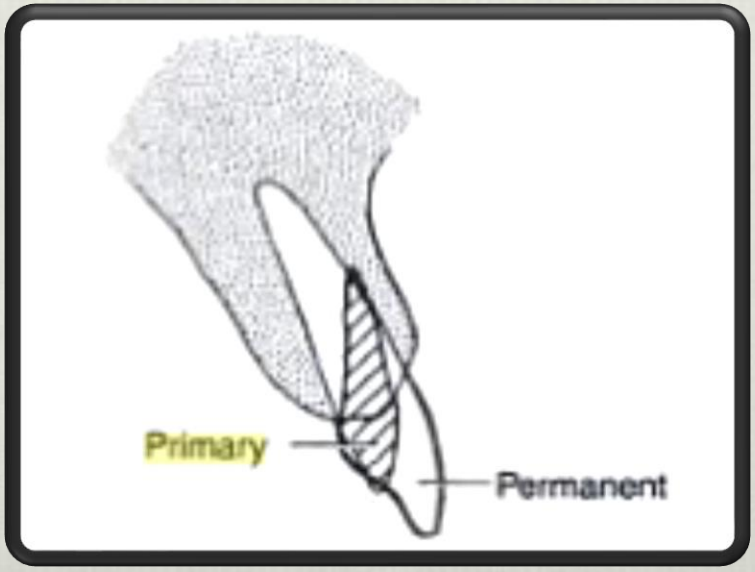
Rapp and Bernick believe that primary teeth are less sensitive to pain than permanent teeth, probably because of difference in the number &distribution of neural elements.

ARCH SHAPE AND TOOTH POSITION

- Four principal factors influence tooth alignment and adjustments in the arches of primary and permanent dentition:
  - Interdental spacing
  - Tooth inclination
  - Arch growth
  - Tooth size



- Primary incisors and canines are more upright than do succeeding permanent teeth.
- Permanent tooth crowns have a more labial inclinationthan do primary tooth crowns.



DENTAL ARCHES

- Intercanine width is greater in permanent dentition than in the primary dentition.

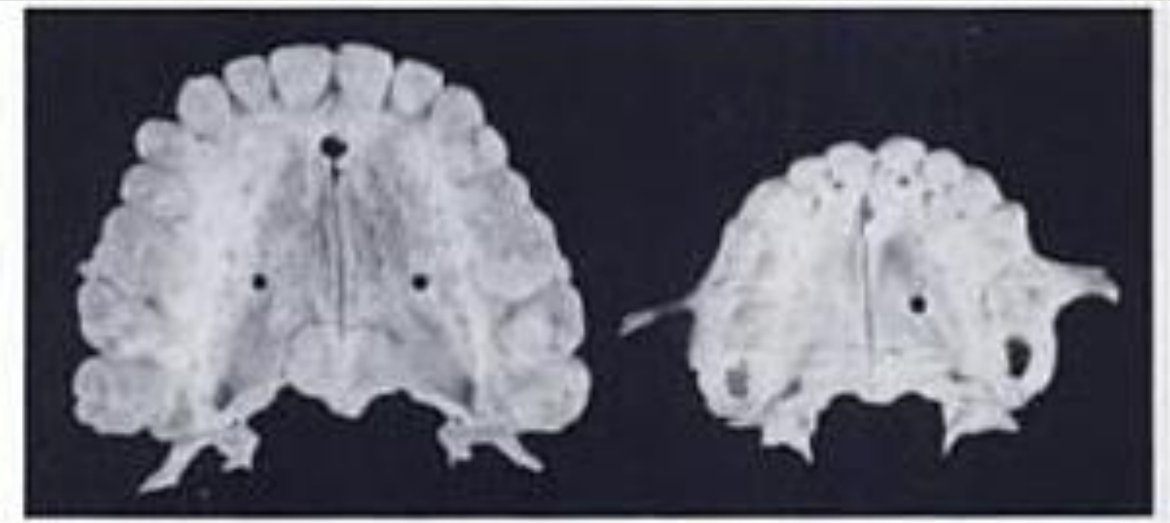
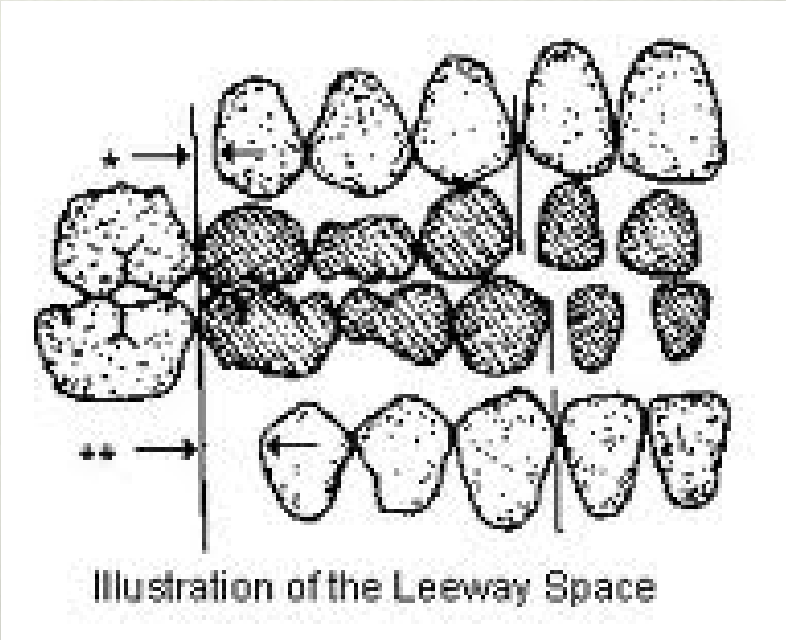


Fig. 12.22 Comparison of dental arches of primary and permanent teeth

LEEWAY SPACE

The difference between the cumulative mesiodistal diameter of the primary molars and canines and those of the premolar & permanent canine is the leeway space.



CARBONATES:

- Carbonates play an important role in enamel maturation and perhaphs in the intial phase of dental caries formation.

- As enamel matures the level of carbonate decreases on the surface of enamel.

CLINICAL SIGNIFICANCE:

- This may explain the relatively greater caries susceptibility of newly erupted teeth and increased resistance of old teeth.

FLUORIDE IN PRIMARY TEETH

- It is believed that fluoride found in inner enamel is mainly during secretary stage of amelogenesis & that found in the outer 30-50um of enamel occurs during maturative stage.
- As the maturative stage lasts longer in permanent teeth(4-5yrs) ,more fluoride to be deposited in outer enamel.
- Reason for less fluoride in primary teeth is maturative stage lasts for only1-2yrs

ENAMEL HYPOPLASIA

Hypoplasia was found in 20% of teeth in the primary dentition(Needleman et al 1991)

Enamel hypoplasia in the primary second molar has been reported in 3.9% of a childern population (Hong et al 2009).

	PRIMARY TEETH	PERMANENT TEETH
Total no.of teeth	20	32
Dental formula	I2/2,C1/1,M2/2	I2/2C1/1PM2/2M3/3
Colour	Milky white	Yellowish white
Size	Smaller	larger
Mammelons	Absent	Present
Crown dimensions	Longer mesiodistally than incisocervically	Longer incisocervically than mesiodistally
Cingulum	More prominent	Less prominent

	PRIMARY TEETH	PERMANENT TEETH
Occlusal table	Narrow	Broader
Ridges and Fossae	Ridges are not pronounced &fossae are not deep	Ridges are pronounced & fossae are deep.
Developmental lines	Labial surfaces of incisors are smooth & don't show any depression & developmental lines.	Faint vertical development lines &grooves are present.
Contact areas	Broader, flatter &situated more gingivally.	Narrower, convex& situated more occlusally.

	PRIMARY TEETH	PERMANENT TEETH
Cervical constriction	Present	Absent
Root formation	Root fully forms about 1yr after eruption	Takes a longer duration of about 3yrs
Anterior root	Narrower mesiodistally & root bend labially in their apical one-third to one-half by 10 degree	Wider mesiodistally & roots bends distally
Posterior root	Longer & slender. Roots are more flared	Shorter & less flared
Root canal	Ribbon like & multiple pulp filaments with numerous accessory canals(branching)	Well defined with less branching

	PRIMARY TEETH	PERMANENT TEETH
Floor of pulp chamber	Porous	Not porous
Accessary canals	More in interradicular region	More in apical region
Apical foramen	Wider	Narrower

HISTOLOGICAL DIFFERENCES:

	PRIMARY TEETH	PERMANENT TEETH
Enamel thickness	Thinner -1mm	Thicker 2-2.5mm
Enamel rod direction	Enamel rods at cervical region slopes occlusally from DEJ	Oriented gingivally
Bands of Retzius	Less common (partly responsible for bluish white color of enamel)	Bands of Retizus are more common
Dentinal tubules	Are less regular	More irregular

	PRIMARY TEETH	PERMANENT TEETH
Density of dentin	Less dense	More dense
Reparative dentin formation	More extensive & more irregular	Less extensive
Cementum	Very thin &of primary type. secondary cementum is absent	Secondary cementum is present
Reticular & collagenous fibers in pulp	Present as a cap like zones	Not so
Blood supply	More	Reduced(because of more calcified nodules)

	PRIMARY TEETH	PERMANENT TEETH
Nerve fibers terminate at	Odontoblastic areas as free nerve ending.	Pre dentin layer
Sensitivity to pain	Less	More
Response to infection & inflammation	Typical	less
Localisation of infection &inflammation	Poor	better


Thank you