# MORPHOLOGIC DIFFERENCES BETWEEN PRIMARY AND PERMANENT TEETH

## *Crowns*

- *The crowns in the primary dentition are shorter relative to the length of the root (i.e., smaller crown: root ratio).*
- *The occlusal tables of primary molars are constricted when compared with those of the permanent molars.*
- *Enamel and dentin are thinner compared with permanent teeth. The thickness is approximately half that of permanent teeth.*
- *The enamel rod direction in the cervical area is angled occlusally compared with the apical direction in permanent teeth.*
- *Crowns of primary teeth are characterized by significant cervical constriction.*
- *The primary molars have a pronounced buccal cervical bulge.*
- *The contact areas of primary molars are flat and very broad compared with the permanent molars.*
- *The crown color of the primary teeth is whiter and a lighter shade.*

## *Roots*

- *The roots of the primary molars have a greater flare, which accommodates the developing crowns of the succedaneous permanent premolars.*
- *The mesio-distal width of the roots of primary anterior teeth is much narrower than the crown when compared with those of the permanent anterior teeth.*
- *The primary molar roots are relatively narrower and more slender.*

## *Pulp and Root Canal Systems*

- *The size of the pulp relative to the crown is larger in the primary teeth.*
- *Pulp horns are higher in proportion and are located closer to the DEJ.*
- *Mesial pulp horns are higher than distal pulp horns.*
- *Pulp horns are present under each cusp of the primary molars.*

- *The pulp chambers of primary mandibular molar teeth are normally larger than the pulp chambers of primary maxillary molars.*

## *Size and morphology of the primary tooth pulp chamber*

*Considerable individual variation exists in the sizes of the pulp chambers and pulp canals of the primary teeth. Immediately after tooth eruption, the pulp chambers are large and generally follow the outline of the crown. They decrease in size as age increases and under the influence of both function and abrasion of the occlusal and incisal surfaces of the teeth.*

*Radiographs do not demonstrate completely the extent of the pulp horn into the cuspal area.*

## PRIMARY ROOT CANAL ANATOMY

*To treat the pulps of primary teeth successfully, the clinician must have a thorough knowledge of the anatomy of the primary root canal systems and the variations that normally exist in these systems. To understand some of the variations in the primary root canal systems requires an understanding of root formation.*

### *Root Formation*

*The roots begin after enamel and dentin formation has reached the future CEJ. The epithelial dental organ forms Hertwig's epithelial root sheath, which initiates formation and molds the shape of the roots. Hertwig's sheath takes the form of one or more epithelial tubes (depending on the number of roots of the tooth, one tube for each root). During root formation the apical foramen of each root has a wide opening. The dentinal walls diverge apically, and the shape of the pulp canal is like a wide-open tube. Each root contains one canal at this time, and the number of canals is the same as the number of roots.*

*When root length is established, the sheath disappears but dentin deposition continues internally within the roots.*

*As growth proceeds, the root canal is narrowed by continued deposition of dentin and the pulp tissue is compressed.*

*Additional deposition of dentin and cementum closes the apex of the tooth and creates the apical convergence of the root canals common to the completely formed tooth.*

*Root length is not completed until 1 to 4 years after a tooth erupts into the oral cavity. In the primary teeth the root length is completed in a shorter period of time than in the permanent tooth because of the shorter length of the primary roots.*

*The primary tooth is unique in so far as resorption of the roots begins after a short period of complete root length formation. At this time the form and shape of the root canals roughly correspond to the form and shape of the external anatomy of the teeth. Root resorption or the deposition of additional dentin within the root canal system, however, significantly changes the number, size, and shape of the root canals within the primary tooth.*

**ROOT COMPLETION OF PRIMARY TEETH**

*Primary tooth roots are completed between the ages of 18 months to 3 years.*

*The complete primary dentition (with 20 teeth) is in the mouth from about 2 years of age to about 6 years, during which no permanent teeth are visible in the mouth, but permanent teeth are forming within the jaws.*

**EXFOLIATION (SHEDDING) OF PRIMARY TEETH**

*The roots of primary teeth are complete for only a short period of time. Only about 3 years after completion, primary tooth roots begin to resorb, usually at the apex or on one side near the apex. Resorption of a primary tooth root is the gradual dissolving away of the root due to the underlying eruption of the succedaneous tooth that will replace it.*

*Root resorption continues as succedaneous teeth move closer to the surface until deciduous teeth eventually become loose and finally "fall off" (like leaves fall off of deciduous trees). This process of shedding is called exfoliation. When a primary tooth is shed, the crown of the succedaneous tooth is close to the surface and ready to emerge.*

***Root canal anatomy of primary anterior teeth***

*The form and shape of the root canals of the primary anterior teeth resemble the form and shape of the roots of the teeth. The permanent tooth bud lies lingual and apical to the primary anterior tooth. Owing to the*

*position of the permanent tooth bud, resorption of the primary incisors and canines is initiated on the lingual surface in the apical third of the roots.*

***Maxillary Incisors***

*The root canals of the primary maxillary, central, and lateral incisors are almost round but somewhat compressed. Normally these teeth have one canal without bifurcations. Apical ramifications or accessory canals and lateral canals are rare, but they do occur.*

***Mandibular Incisors***

*The root canals of the primary mandibular central and lateral incisors are flattened on the mesial and distal surfaces and sometimes grooved, pointing to an eventual division into two canals. The presence of two canals is seen less than 10% of the time. Occasionally lateral or accessory canals are observed.*

***Maxillary and Mandibular Canines***

*The root canals of the maxillary and mandibular canines correspond to the exterior root shape, a rounded, triangular shape with the base toward the facial surface. The canines have the simplest root canal systems of all the primary teeth and offer few problems when being treated endodontically. Bifurcation of the canal does not normally occur. Lateral canals and accessory canals are rare.*

## *Root canal anatomy of primary molars*

*Normally the primary molars have the same number and position of roots as the corresponding permanent molars. The maxillary molars have three roots: two facial and one palatal; the mandibular have two roots: mesial and distal. In the primary molars, resorption usually begins on the inner surfaces of the roots next to the inter-radicular septum.*

*When full length of the roots of the primary molars has just been completed, only one root canal is present in each of the roots. The continued deposition of dentin internally may divide the root into two or more canals. During this process, communications exist between the canals and may remain in the fully developed primary tooth.*

*Subsequent deposition of secondary dentin may produce a complete separation of the root canal into two or more individual canals. Many fine-*

*connecting branches or lateral fibrils form a connecting network between the facial and lingual aspects of the root canals. Accessory canals, lateral canals, and apical ramifications of the pulp in primary molars occur in 10% to 20%.*

***Maxillary First Primary Molar***

*It has two to four canals that roughly correspond to the exterior root form with much variation. The palatal root is often rounded; it is often longer than the two facial roots.*

*In most of these teeth three separate canals are present, with a very narrow isthmus connecting them especially between the palatal and distal. Islands of dentin may exist between the canals, with many connecting branches and fibrils.*

***Maxillary Second Primary Molar***

*It has two to five canals roughly corresponding to the exterior root shape. The mesiofacial root usually bifurcates or contains two distinct canals. This occurs in approximately 85% to 95% of maxillary second primary molars.*

*Fusion of the palatal and distofacial roots may occur. These fused roots may have a common canal, two distinct canals, or two canals with a narrow connecting isthmus of dentin islands between them and many connecting branches or fibrils.*

***Mandibular First Primary Molar***

*It usually has three canals roughly corresponding to the external root anatomy, but it may have two to four canals. It is reported that approximately 75% of the mesial roots contain two canals, whereas only 25% of the distal roots contain more than one canal.*

***Mandibular Second Primary Molar***

*It may have two to five canals, but it usually has three. The mesial root has two canals approximately 85% of the time, whereas the distal root contains more than one canal only 25% of the time.*