Development of the tooth and its supporting tissues:

Primary epith. Band

After about 37 days of development a continuous band of thickened epith. forms around the mouth in the presumptive upper and lower jaws. These bands are roughly horseshoe shaped and correspond in position to the future dental arches of the upper and lower jaws. Each band of epith. called the primary epith. band, quickly gives rise to two subdivisions: the dental lamina, which forms first, and the vestibular lamina, which forms shortly afterward and which is positioned just in front of the dental lamina. a key feature of the initiation of tooth development is the formation of localized thickenings or placodes within the primary epith band

Dental lamina:

On the anterior aspect of dental lamina continued and localized proliferative activity leads to the formation of a series of epith. out growths into the ectomesenchyme at sites corresponding to the positions of the future deciduous teeth .

Vestibular lamina:

The vestibule forms as a result of the proliferation of the vestibular lamina into the ectomesenchyme soon after formation of the dental lamina. The cells of the vestibular lamina rapidly enlarge and the degenerate to form a cleft that becomes the vestibule between the check and the tooth–bearing area.

Initiation of the tooth:

Bud stage:

The bud stage is represented by the first epith. incursion into the ectomesenchyme of the jaw. The epith. cell show little if any change in shape or function, the supporting ectomesenchyme cell are packed closely beneath and around the epith. bud.

Cap stage:

As the epith. bud continues to proliferate into the ectomes., cellular density increase immediately adjacent to the epith. outgrowth by process called condensation of ectomesenchyme result from a local grouping of cells that not separated from each other, at this stage the tooth bud grow larger and identifying the formative elements of the tooth and its supporting tissues. The epith. outgrowth which resemble a cap sitting on a ball of condensed ectomesnchyme is referred as enamel organ and the ball of condensed ectomes. cells called the dental papilla will form the dentin and pulp while the dental follicle or sac gives rise to the supporting tissues of the tooth so that this stage of tooth development is called cap stage.

The enamel organ, dental papilla, and dental follicle together constitute the dental organ or tooth germ. Those structures giving rise to the dental tissues (enamel, dentin-pulp, supporting apparatus of tooth), the cells in the center of the enamel organ synthesize and secrete glycosaminoglycans into the extra cellular compartment between the epith. cells and act a hydrophilic so pull water into the enamel organ and lad to increase amount of fluid (increase the volume of the extra cellular compartment), the center of the enamel organ is termed stellate reticulum.

Enamel knots: are clusters of nondividing epithelial cells visible in sections of molar cap stage tooth germs, the physical role of the enamel knot is not known.

Bell stage:

During this stage, the tooth crown assumes its final shape (morphodifferentiation) and the cells that will be making the hard tissues of the crown (ameloblasts and odotoblasts), at the periphery of the enamel organ the cells assume a low cuboidal shape and form the outer enamel epithelium, the cells bordering on the dental papilla assume a short columnar shape and are characterized by high glycogen content together they form the inner enamel epithelium.

The zone of reflexion or cervical loop is the region where the inner and outer epith. is meeting at the rim of the enamel organ. This point is where the cells continue to divide until the tooth crown takes its full size (crown formation) after that gives rise the epith. component of root formation.

In the bell stage, some epith. cells between the inner enamel epith. and the stellate reticulum differentiate into a layer called stratum intermedium this cells are characterized by a high activity of the enzyme alkaline phosphatase.

Dental papilla and follicle:

The dental papilla is separated from the enamel organ by a basal lamina from which a mass of fine periodic fibrils extends into a cellular zone; the dental papilla is referred to as the tooth pulp when the first calcified matrix appears at the cuspal tip of the bell stage tooth germ. The dental follicle is distinguished from the dental papilla in that many collagen fibrils occupy the extracellular spaces between the follicular fibroblasts; these generally are oriented circularly around the dental organ and dental papilla.

Breakup of the dental lamina and crown pattern determination:

Two other important events occur during the bell stage: 1st the dental lamina and lateral lamina joining the tooth germ to the oral epith. fragments, eventually separating the developing tooth from the oral epithelium, second the inner enamel epith. completes its folding making it possible to recognize the shape of the future crown pattern of the tooth. Fragmentation of dental lamina results in the formation of discrete clusters of epithelial cells that normally degenerate, these clusters of cells may form small cysts (eruption cysts) over the developing tooth and

delay eruption or give rise to odontomes or may activated to form supernumerary teeth. Before the tooth can function, it is reestablish a connection with oral epithelium and penetrate it to reach the occlusal plane. Integrity is reestablished by formation of a special seal around the tooth called (junctional epith.), when the junction integrity is compromised the gingivitis and periodentitis is formed.

When the tooth germ is growing rapidly during the cap-to-bell stage, cell division occurs throughout the inner enamel epith., the point at which inner enamel epith. cell differentiation first occurs represents the site of future cusp development or the growth center, the continued cell proliferation causes the inner enamel epith. to buckle and form a cuspal outline and is followed by the deposition of dentin and enamel, those two matrices are deposited face to face, thereby defining the dentinoenamel junction and the occurrence of 2nd zone of cell differentiation within the inner enamel epith. leads to formation of 2nd cusp and so on until the final cuspal pattern of the tooth is determined.

Formation of the permanent dentition:

The tooth germs that give rise to the permanent incisors, canines, and premolars form as a result of proliferative activity within the dental lamina, this increased proliferative activity leads to the formation of another tooth bud on the lingual aspect of the deciduous tooth germ which remain dormant for some time. The molars of the permanent dentition have no deciduous predecessors, so their tooth germs do not originate in the same way, the dental lamina burrows posteriorly beneath the lining epith. of the oral mucosa into the ectomesnchyme during the jaw grown long. This backward extension of the dental lamina of forming mandible lead to present the teeth in flattened bony ramus of the adult mandible.

The entire primary dentition is initiated between the sixth and eight weeks of embryonic development, the secondary dentition between the twentieth week in uterus and the tenth month after birth (the first molar between the twentieth week in uterus and the fifth year of life (third molar).

Root formation:

The root of tooth consists of dentin covered by cementum, the epithelial cells of the inner and outer enamel epith. proliferate from the cervical loop of the enamel organ to form a double layer of cells known as Hertwig's epithelial root sheath, this sheath extends around the dental pulp between the latter and the dental follicle until it encloses all but the basal portion of the pulp, the primary apical foramen encloses by the rim of this root sheath (epithelial diaphragm).

The inner epith. cells of the root sheath initiate the differentiation of odontoblasts from ectomesenchymal cells at the periphery of the pulp, these cells eventually form the dentin of the root. Once the root sheath forms, it rapidly initiate root formation and the crown of the tooth is growing away from the bony base of the crypt. The cell division occurs in the root sheath and form number of clusters of epith. cells separated from the surrounding connective tissue by a basal lamina known as epithelial cell rests of malassez, in adult these epith. cell rests next to the root surface within the periodontal ligament.

Tooth eruption:

In erupting , the crown of the tooth must escape from its bony crypt and pass through the lining mucosa of the oral cavity, as eruptive movement begins the enamel of the crown still is covered by layer of ameloblasts and remnants of the other three layers of enamel organ.

The bone overlying the erupting tooth soon is resorbed and the crown passes through the connective tissue of the mucosa, which is broken down in advance of the erupting tooth. The reduced dental epithelium (formed by ameloblasts and adjacent cells) and the oral epith. fuse and form a solid mass of epithelial cells over the crown of tooth. The central cells in this mass degenerate forming an epithelial canal through which the crown of the tooth erupts and after the tooth erupt another development occurs: the dentogingival junction forms from epith. cells of the oral epithelium and the reduced enamel epithelium.

Formation of supporting tissues:

While roots are forming , the supporting tissues of the tooth also develop, the supporting tissues of the tooth form from the dental follicle. As the root sheath fragments, ectomesenchymal cells of the dental follicle

penetrate between the epithelial fenestration and become apposed to the newly formed dentin of the root, these cell differentiate into cementum-forming cells (cementoblasts). These cells elaborate an organic matrix that becomes mineralized in which the collagen fiber bundles of the periodontal ligament become anchored.