Dentinogenesis
Dentinogenesis takes place in two phases
1- Collagen matrix formation
2- Deposition of hydroxyapatite (mineralization)

1- Matrix formation:
The matrix begins at the cusp tips after odontoblasts differentiated & change from an ovoid to a columnar shape & increased in length to approximately 40 µm.
Initially daily increments of approximately 4 µm of dentin are formed. This continues until the crown is formed & the teeth erupt & move into occlusion (primary dentin). After this time dentin production slows to about 1 µm/day (secondary dentin). After root development is complete, dentin formation may decrease further.
As each increment of predentin is formed along the pulp border, it remains a day before it is calcified & the next increment of predentin forms. The initial dentin deposition along the cusp tips defined as Korff’s fibers.
However, odontoblasts cells gradually moves pulp ward, & leave a process known as the odontoblast process.
The dentinal matrix is first a meshwork of collagen fibers & it’s called predentin, but within 24 h it becomes calcified & called dentin.
As the odontoblastic process elongates, a tubule is maintained in the dentin & the matrix is formed around the tubule & the odontoblasts maintain their elongating processes in dentinal tubules.

2- Mineralization:
The earliest crystal deposition is in the form of very fine plates of hydroxyapatite on the surfaces of the collagen fibrils & in the ground substance, then, crystals are laid down within the fibrils themselves & arranged parallel with the long axes of the fibrils.
The general calcification process is gradual, but the peritubular region becomes highly mineralized at a very early stage.
The crystals grow, spread, & coalesce until the matrix is completely calcified. Only the newly formed band of dentinal matrix along the pulpal border is remain uncalcified.
As each daily increment of predentin forms along the pulpal boundary, the adjacent peripheral increment of predentin formed the previous day calcified
& becomes dentin.

**Sclerotic dentin:**
Stimuli may not only induce additional formation of reparative dentin, but also lead to protective response in the dentin.
In case of caries, attrition, abrasion, erosion, or cavity preparation sufficient stimuli are generated to cause collagen fibers & apatite crystals appearing in the dentinal tubules.
In such cases blocking of the tubules may be considered as a defense reaction of the dentin.
Gradually, the tubule lumen is obliterated with mineral, which appears very much like the peritubular dentin.
Sclerotic dentin can be observed in the teeth of elderly people, specially in the roots, and may also be found under slowly progressing caries.

**Dentinoenamel junction:**
The junction between enamel & dentin termed dentinoenamel junction.
Is scalloped which assures the firm hold of the enamel cap on the dentin.
The convexities of the scallops are directed toward the dentin.
In addition to scalloping DEJ, other features like enamel spindles & fine branching of the terminal tubules are found within the junction.

**Clinical considerations**
1-the cells of the dentin should not be exposed to bacterial toxins, strong drugs, undue operative trauma, unnecessary thermal changes, or irritating restorative materials, because 1mm² of dentin when exposed about 30000 living cells are damaged.
2-the rapid penetration & spread of caries in the dentin is the result of the tubules provide a passage for invading bacteria & their products through either a thin or thick dentinal layer.
3-dentin sensitivity of pain, unfortunately, may not be a symptom of caries until the pulp is infected & responds by the process of inflammation, leading
to toothache. Thus patients are surprised at the extent of damage to their teeth with little or no warning from pain.