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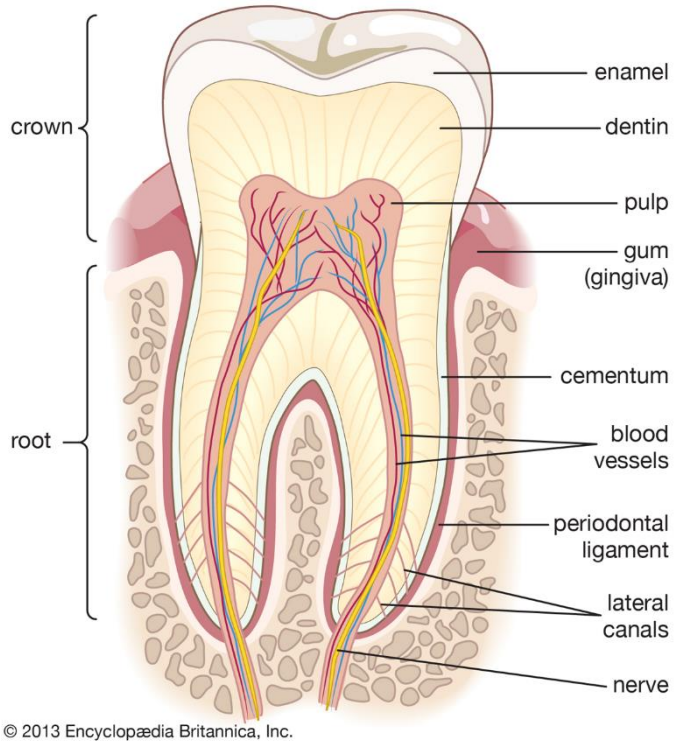
Second stage - Al Ameed University

College of Dentistry 2024-2025

Pulp

The dental pulp is a well ***vascularized specialized loose connective tissue***, almost entirely enclosed by dentin. It is contained within the pulp chamber and root canals of the tooth. At the ***apical foramen*** it is continuous with the periodontal ligament. Pulp and dentin together form an embryological and functional unit called dentin –pulp complex.



The pulp is of ectomesenchymal origin, and developed from the dental papilla**.**

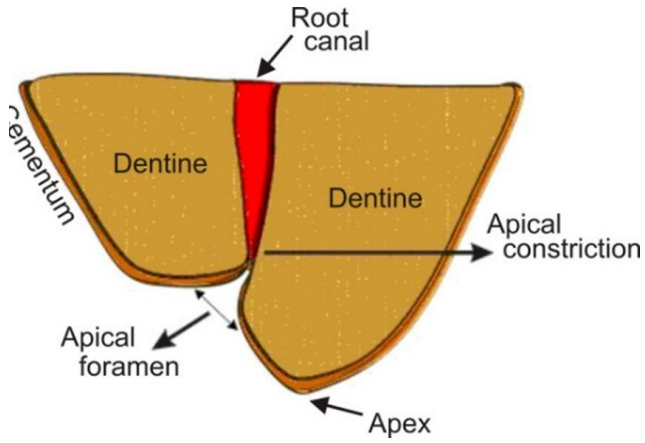
Each pulp is composed of a **coronal pulp** located centrally in the crown of the teeth and the root or **radicular pulp**.

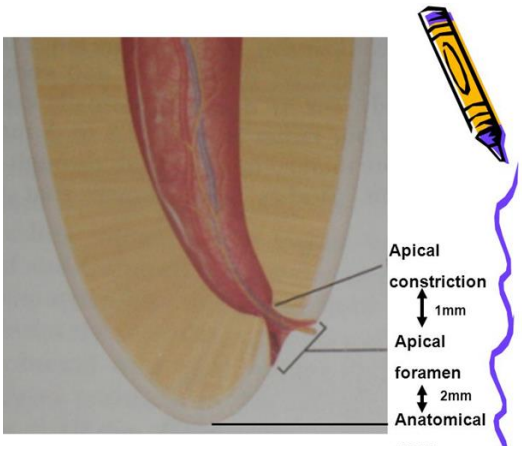
Apical foramen

Is defined as the apical opening in the root canal. Root canal morphology especially in the apical third is a critically important factor during conventional root canal treatment and surgical endodontics.

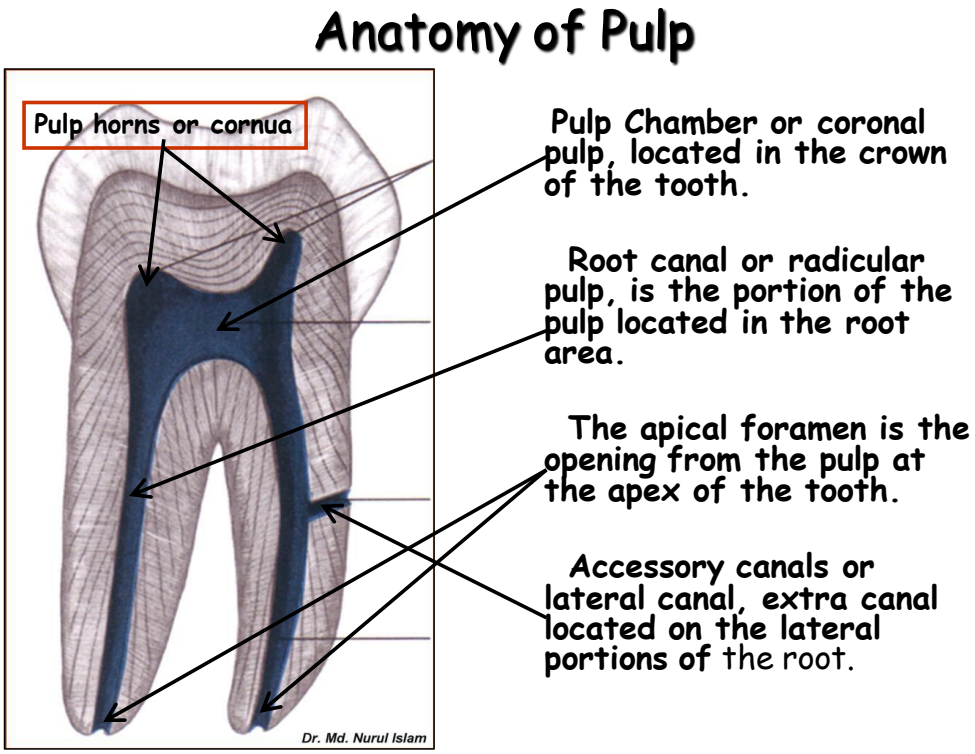
The apical constriction

Is defined as the apical part of the root canal with the narrowest diameter. It is narrowest area extending along a distance of **0.1 mm** or more at the **apex**.





Accessory canals: Where there is a connection between the pulp and the periodontal ligament other than the point of the apical foramen.

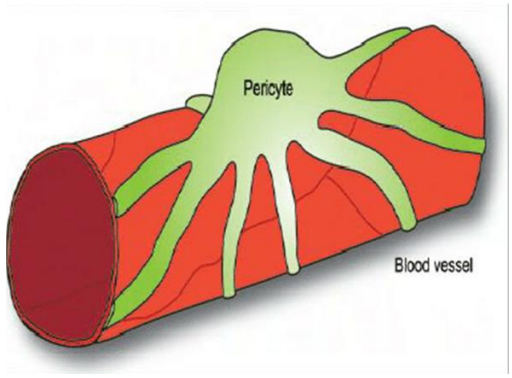


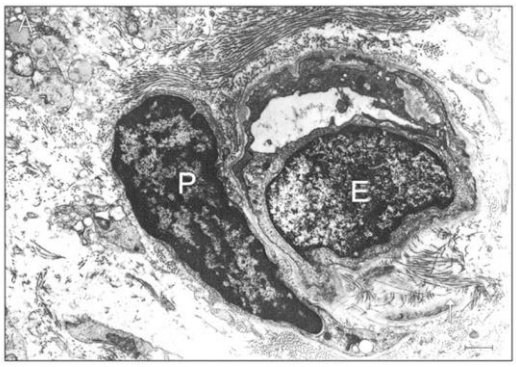
Histological Structure

The dental pulp is formed **of specialized loose connective tissue**. It is formed of the three elements: cells, fibers, intercellular substance, and blood vessels and nerves. The intercellular substance is dense and gel –like in consistency. It is formed of hyaluronic acid which is non-sulfated glycosaminoglycan and glycoprotein.

1. Cells: The cells of the pulp may be divided into:

a. Formative cells: odontoblasts and fibroblasts.
b. Defensive cells: macrophages, lymphocytes, eosinophils, mast cells and plasma cells.
c. Progenitors: undifferentiated ***ectomesenchymal cells***: They are usually found around the walls of blood vessels (**perivascular or *pericytes cells***). These cells have the potentiality of forming other types of formative or defensive connective tissue cells. These cells give rise to new generation of odontoblast which are needed in case of ***deep penetrating caries and cavity preparation to form reparative dentin.***





2-Fibrous matrix: Which contain type I and II collagen fibers. Type I collagen is produced by the odontoblasts which present in the periphery of the pulp, while Type II collagen is produced by the fibroblasts in the pulp.

3-Ground substance: is represent the environment that surrounds both cells and fibers of the pulp and is rich in proteoglycans, glycoproteins and large amounts of water.

Zones of the pulp

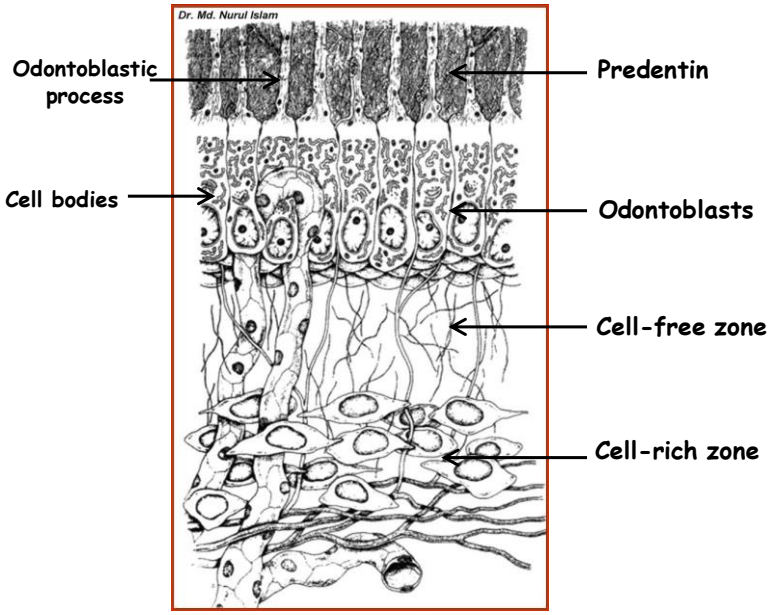
1. Odontoblastic cells layer: Close to the reparative dentin.

2. Cell free zone: it is free of cells but contain plexus of nerve fibers which entering to the dentinal tubules.

3. Cell rich zone: The cell rich zone is composed mainly of fibroblasts and undifferentiated ectomesenchymal cells.

4. pulp core: This contains Raschkow plexus of nerves and main blood vessels in the pulp.

***The odontogenic zone*: is composed of odontoblasts, the cell free zone, and the cell rich zone. It is called so because it is responsible for the formation of different types of dentin throughout the life of the tooth.**



Innervation of the pulp:

Sensory response in the pulp cannot differentiate between heat, touch, pressure, or chemicals. This is because the ***pulp is only containing pain receptors***. So, the sensory nerve endings in the pulp are presumed to function in pain reception only.

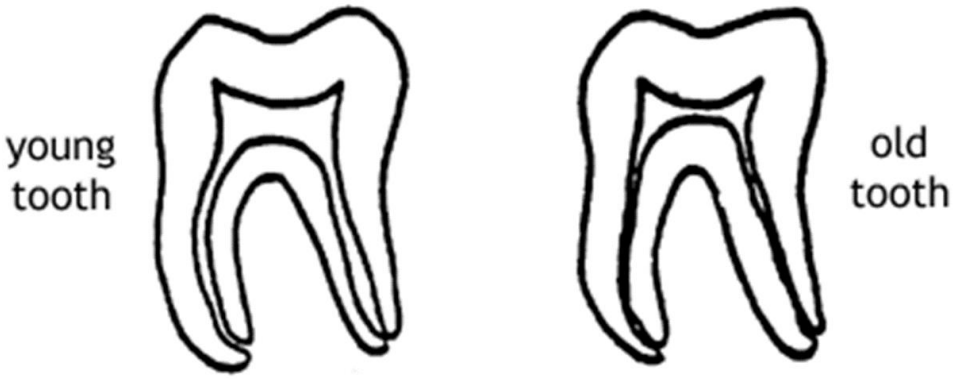
Several large nerves enter the apical foramen of each molar and premolar with single ones entering the anterior teeth.

These nerves have two types:

1. Autonomic Nerve Fibers. They are unmyelinated fibers and travel with the blood vessels. They innervate the smooth muscle cells of the arterioles and therefore function in regulation of blood flow in the capillary network.
2. Afferent (Sensory) Fibers. These arise from the maxillary and mandibular branches of the fifth cranial nerve (trigeminal). They are predominantly myelinated fibers and may terminate in the central pulp.

The age changes of the pulp:

1. The age changes are more accelerated in primary teeth than permanent teeth.
2. Decrease in number of cells: there are fewer cells in the aging pulp. The cells are characterized by decrease in size and number of cytoplasmic organelles. There is also decrease in the undifferentiated ectomesenchymal cells which lead to a diminishing in the pulp ability for repair and regenerative ability.
3. Fibrosis: Increase and accumulation of both bundles and bundles of collagen fibers. The ground substance becomes less aqueous.
4. Decrease in blood supply due to progressive narrowing of the apical foramen, leading to the decrease in the vitality of the odontoblasts.
5. **Pulp recession: As a result of deposition of both secondary and tertiary dentin.**



6. Increase number of Pulp stones (denticles): Are calcified masses appearing either in coronal or radicular pulp.

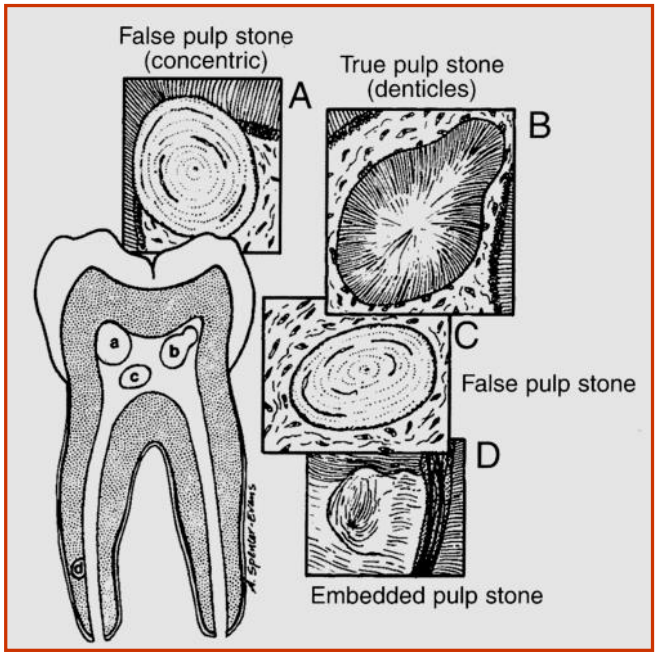
Pulp Stones or denticles:

Small calcified bodies are present in up to 50% of the pulp of newly erupted teeth and in over 90% of older teeth. These bodies are classified by either their structures or locations:

1. Structure of the pulp stones:
   A calcified body containing tubular dentin is referred to as a "**true**" pulp stone. True pulp stones exhibit radiating striations of dentinal tubules.

   Irregularly calcified tissue generally does not bear much resemblance to any known tissue and as such is referred to as a "**false**" pulp stone. False pulp stones generally exhibit either a hyaline-like homogeneous morphology or appear to be composed of concentric lamellae.

2. Locations of the pulp stones:
   1- Free in the pulp
   2- Embedded inside the dentin
   3- Attached to the dentin



Clinical consideration:

The pulp cavity extends down through the root of the tooth as the root canal which opens into the periodontium via the apical foramen. The blood vessels, nerves etc. of dental pulp enter and leave the tooth through this foramen. This sets up a form of communication between the pulp and surrounding tissue.

clinically important in the spread of inflammation from the pulp out into the surrounding periodontium.