Oral Histology

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Dental Pulp

The Pulp is a soft mesenchymal connective tissue that occupies pulp cavity in the central part of the teeth. Every person normally has a total of *52 pulp organs*, 32 in the permanent & 20 in the primary teeth. Molar pulps are *3 to 4 times* larger than incisor pulps. Cuspid has the longest pulp, Mandibular central incisor has the smallest pulp. Pulp has a soft, gelatinous consistency, indicates that the majority of pulp (75-80%) is water. Developmentally and functionally, pulp and dentin are closely related. Both are products of the dental papilla.

Types of Pulp:

1. Coronal pulp : occupies the crown of the tooth and has six surfaces; occlusal, mesial, distal, buccal, lingual and the floor.

Pulp horns are protrusions of the pulp that extend up into the cusps of the tooth. With age, pulp horns diminish and the coronal pulp decreases in volume due to continued (secondary) dentin formation

2. Radicular pulp : extends from the cervical region down to the apex of the tooth. Molars and premolars exhibit multiple radicular pulps. This pulp is tapered, it also decreases in volume with age due to continued dentin formation.

Histology of dental pulp:

Dental pulp is a loose connective tissue ,so it contains the components common to all connective tissues such as:

1-Cells: Which include fibroblasts and undifferentiated mesenchymal cells as well as other cell types (macrophages, lymphocytes, etc.) required for the

maintenance and defense of the tissue . Also odontoblasts comprise the outermost region of the pulp, immediately adjacent to the dentin component of the tooth.

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- **Odontogenic zones:** This is peripheral aspect of dental pulp, which contain the odontoblast cells.
2- **Cell-free zone or zone of Weil** : This region does not contain cells but contains numerous bundles of fibers, numerous capillaries and nerves.
3- **Cell-rich zone:** This containing numerous fibroblasts (the predominant cell type of pulp) and undifferentiated mesenchymal cells are also present in the pulp and can give rise to new odontoblasts, fibroblasts or macrophages.
4- **Pulp core:** This contains Raschkow plexus of nerves and main blood vessels in the pulp.

Vascular Supply to the Pulp: One or more small arterioles enter the pulp via the apical foramen and ascend through the radicular pulp of the root. Once they reach the pulp chamber in the crown they branch out peripherally to form a dense capillary network immediately under - and sometimes extending up into - the odontoblast layer. Small venules drain the capillary bed and eventually leave as veins via the apical foramen.

Blood flow is more rapid in the pulp than in most areas of the body and the blood pressure is quite high.

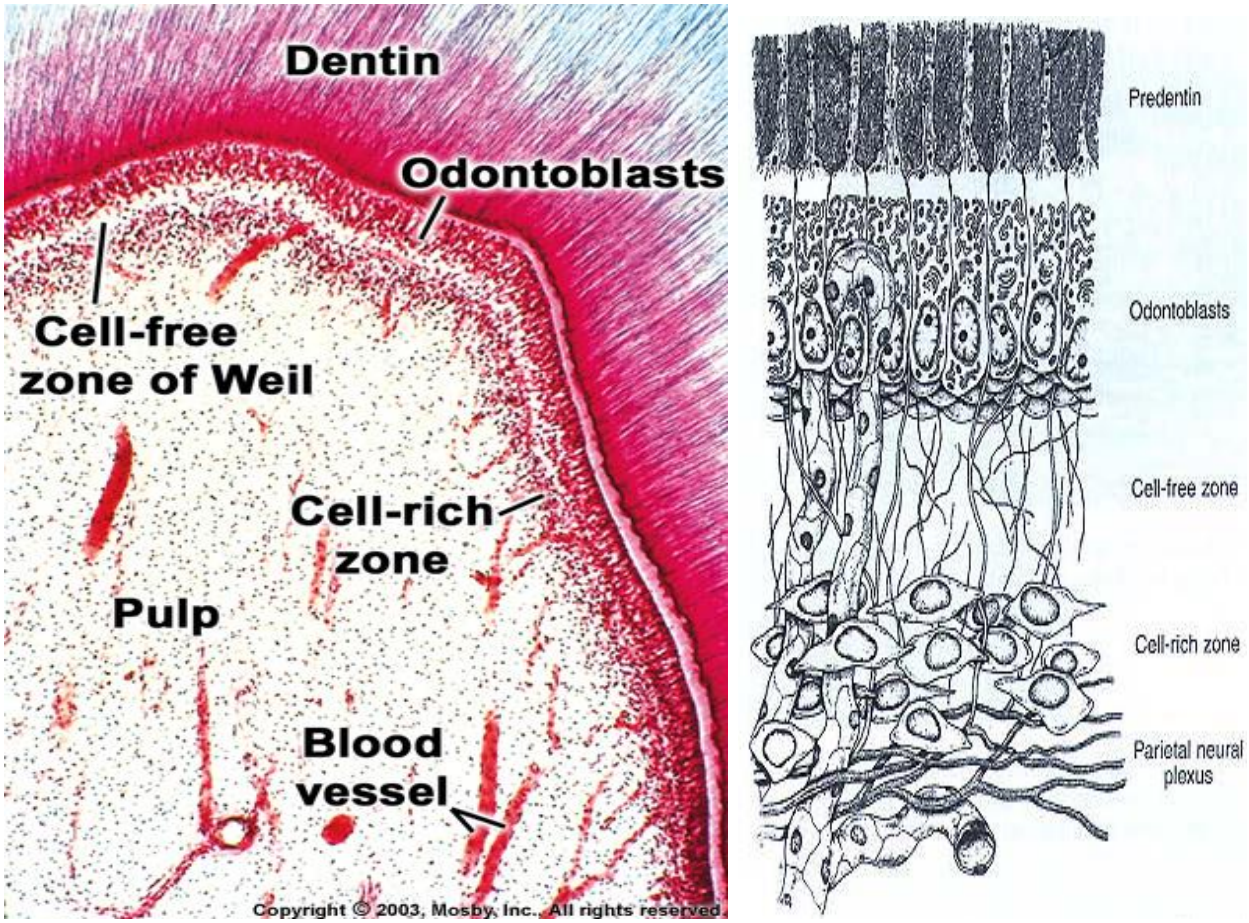

Figure:-Zones of the pulp

Innervation of the Pulp:

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.

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

Age- Changes in the Pulp:

Specific changes occur in dental pulp with age ,which include:

a) less cellular

b) more fibrous

c) overall reduction in volume due to the continued deposition of dentin (secondary or reparative).

d) increase number of pulp stones .

Functions of Dental Pulp:

The primary function of dental pulp is *providing vitality to the tooth*. Dental pulp also has several other functions:-

- **inductive**: very early in development the future pulp interacts with surrounding tissues and initiates tooth formation.
- **formative**: the odontoblasts of the outer layer of the pulp organ form the dentin that surrounds and protects.
- **protective**: A direct response to cutting procedures, caries, extreme pressure, etc., involves the formation of *reperative dentin* by the odontoblast layer of the pulp. Formation of sclerotic dentin, in the process of obliterating the dentinal tubules, is also protective to the pulp, helping to maintain the vitality of the tooth.

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.