Pulp Morphology and Histology
Study objectives

• Describe the pulp morphology and histology
• Discuss the application of the pulp anatomy to pulp therapy
Introduction

• Preservation of primary tooth whose pulp has been endangered by deep carious lesions or trauma is a major problem in caring for the teeth of children.
• It is important to understand the pulp to be able to identify how best to support manage it.
Reasons for preserving tooth

- Reduce the likelihood of mesial drift of adjacent teeth and the resultant malocclusion.
- Aid in mastication.
- Preserve a pulpally involved primary tooth in the absence of a succedaneous tooth.
- Prevent possible speech problems.
• Maintain esthetics.
• Prevent aberrant tongue habits.
• Prevent the psychological effects associated with early tooth loss.
• Maintain normal eruption time of the succedaneous teeth.
Development of the pulp

- Development of dental pulp begins at 8th week of embryonic life.
- As peripheral dental papilla cells transform into columnar shaped odontoblast, they develop cell processes.
- The odontoblasts then begin dentin formation.
During dentinogenesis, the papilla becomes surrounded by dentin and is then termed the pulp organ.

• Cells of the pulp organ are seen to be fibroblasts and appear in a delicate reticulum.
• Young dental papilla is highly vascularized and capillaries crowd among of the odontoblast during actual dentinogenesis.
• Large vessels traverse the central area of the pulp while smaller once are seen in the periphery.
Although large nerve trunks are located near the developing young teeth, only a few nerves associated with blood vessels enter the developing young pulps.

As teeth erupt and come to function the larger myelinated nerve become more abundant.
Functions of the pulp

• Before attempting pulp therapy in the primary dentition, the clinician should be anatomy and physiology of the pulp, as well as the differences between primary and permanent root canal anatomy.
• The pulp has five different functions.
Induction

- Pulp participates in the induction and development of odontoblasts and dentine, which, when formed, induce enamel formation.
Formation

- Odontoblasts form dentine. Dentine is formed continuously throughout the life of the tooth. Odontoblasts can also form a unique type of dentin in response to injury, such as occurs with caries, trauma, and restorative procedures.
Nutrition

• Via dentinal tubules, pulp supplies nutrients that are essential for dentin formation and hydration.
Defense

• Odontoblasts form dentine in response to injury, particularly when the original dentin thickness has been compromised by caries, wear, trauma, or restorative procedures.
Defense (2)

- Pulp also has the ability to elicit an inflammatory and immunologic response in an attempt to neutralize or eliminate invasion of dentin by caries-causing microorganisms and their byproducts.
Sensation

- Through the nervous system, pulp transmits sensations mediated through enamel or dentin to the higher nerve centers.
Morphology of the Root Canal

- The root canals of anterior primary teeth are relatively simple, have few irregularities, and are easily treated endodontically.
- The root canal systems found in posterior primary teeth, conversely, contain many ramifications and deltas between canals making thorough debridement quiet difficult.
Simultaneously, secondary dentin is deposited within the root canal system. The deposition produces variations and alterations in the number and size of the root canals, as well as many small connecting branches between the facial and lingual aspects of the canals. Accessory canals, lateral canals, and apical ramifications of the pulp may be found in 10 to 20% of primary molars. Primary teeth have characteristic ribbon-like radicular pulp. Primary molar roots are widely divergent and curved to allow for the development of the succedaneous tooth.

Generally, there is only one canal present in each root of the primary molars when the formation of the roots has been completed. The primary tooth root will begin to resorb as soon as the root length is completed. The resorption causes the position of the apical foramen to change continually.
• The maxillary primary molars may have two to five canals, with the palatal root usually rounder and longer than the two facial roots.
• In the mesiofacial root, two canals occur in approximately 75% of the primary maxillary first molars and 85 to 95% of primary maxillary second molars.
• The primary mandibular first and second molars usually have three canals which generally correspond to the external root canal anatomy.

• Approximately 75% of the mesial roots in primary first molars contain two canals; whereas in primary second molars, 85% of the mesial roots contain two canals.
Histological content of pulp

- Blood vessels
- Nerve tissue
- Undifferentiated mesenchymal cells
- Fibroblasts
Histological content of pulp - 2

- Defense cells: neutrophils, macrophages
- Odontoblasts
- Osteoclasts/ Odontoclasts
The pulp does not contain lymphatic vessels contrary to popular opinion. A 2010 immuno-histochemical study showed that the pulp does not contain true lymphatic vessels.
• The odontoblast is the most specialized and distinctive cell of the dental pulp and is responsible for the formation of primary, secondary, and reparative dentine.
• The odontoblast is also an end cell that cannot divide.
Replacement of odontoblasts occurs through differentiation and migration of other mesenchymal type cell in the dental pulp.
• Just below the odontoblast layer is a relatively cell free zone where there is an extensive plexus of unmyelinated nerve endings and blood capillaries that support the odontoblasts and provide sensitivity to the dentine.
• The core of dental pulp contains large blood vessels and nerves surrounded by a loose alveolar type of connective tissue.
When pulps are injured by infectious and noninfectious causes, it is best to attempt maintenance of pulp vitality.

However, once a tooth is fully formed, it may continue to remain functional in the clinical sense without a physiologically active pulp.
• Consequently in the mature tooth, it is possible to stabilize pulp autolysis (as in the mummification of the primary tooth pulp) or eliminate the pulp entirely without significantly compromising tooth behaviour.

• In partially developed teeth it is best to retain pulp activity, at least until dental development has been completed.
Healing potential of the pulp

This is a function of:

• The vascularity of the pulp
• The absence of cariogenic and inflammatory bacteria.
• The cellular/structural integrity of the pulp/dentine/enamel complex.
• The absence of a chemical and/or thermal insult.
Reference

• Assignment On Pulp Therapy Permanent Teeth by Dr. Binita Srivastava Deepika Singhal, Dr. H.P. Bhatia, Dr. Archana Aggarwal, Dr. Harshita Kaushik – 30th December, 2009.
The healing potential of the pulp is a function of:

- The vascularity of the pulp
- The presence of cariogenic bacteria.
- The cellular integrity of the pulp/dentine/cementum complex.
- The absence of a chemical and/or thermal insult.
The pulp contains:

- Blood vessels
- Nerve tissue
- Undifferentiated mesenchymal cells
- Fibroblasts
- Lymphocytes
Functions of odontoblasts:

- Odontoblasts form dentine continuously throughout the life of the tooth.
- Odontoblasts converts to osteoblasts in response to injury, such as occurs with caries.
- Odontoblasts provides nutrient for the dentine.
- It serves as the nerve for enamel.
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