Orofacial pain

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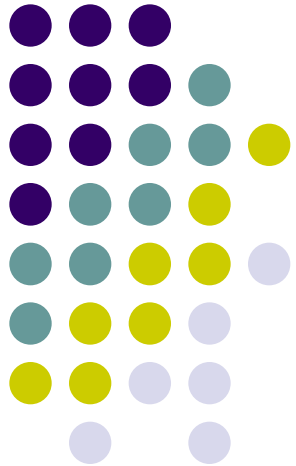


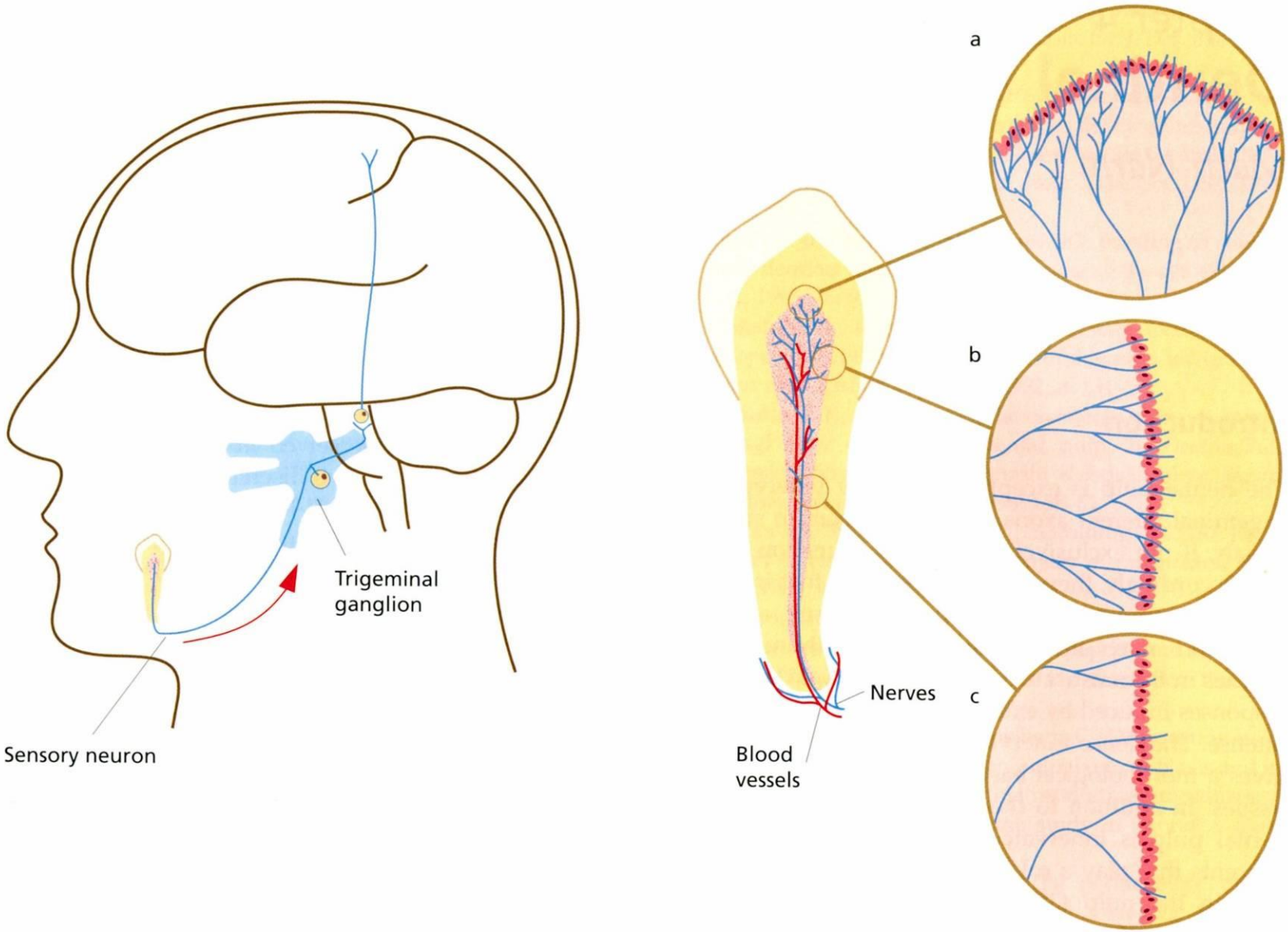


Fig. 4.1 Schematic drawing presenting the innervation of the dental pulp. Several branches from the alveolar nerve enter the apical area of the tooth. A part of the nerve bundles innervate the periodontal tissues. Multiple bundles enter the pulp in close proximity to the blood vessels through the apical foramen; they branch further on their way to the tooth crown. Most of the intradental axons have their terminals in the pulp/dentine border of the coronal pulp, which is the most densely innervated area in the tissue (a). There are fewer nerve endings in the cervical area (b) and the pulp/dentine border in the root pulp is sparsely innervated (c).

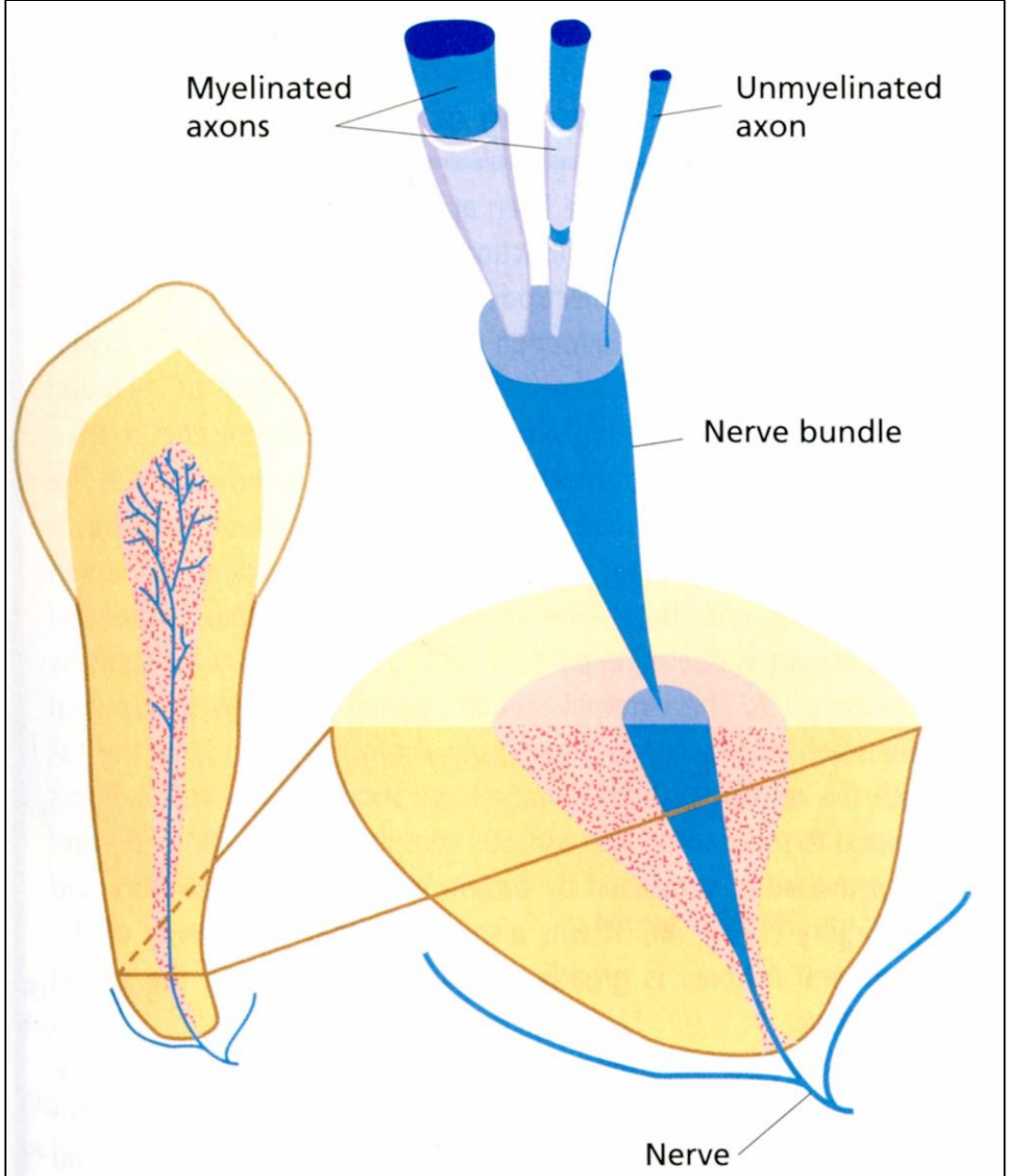


Fig. 4.2 A schematic drawing showing a nerve bundle entering the pulp chamber in the apical area of the tooth. The nerve bundle contains both unmyelinated and myelinated axons of variable sizes.

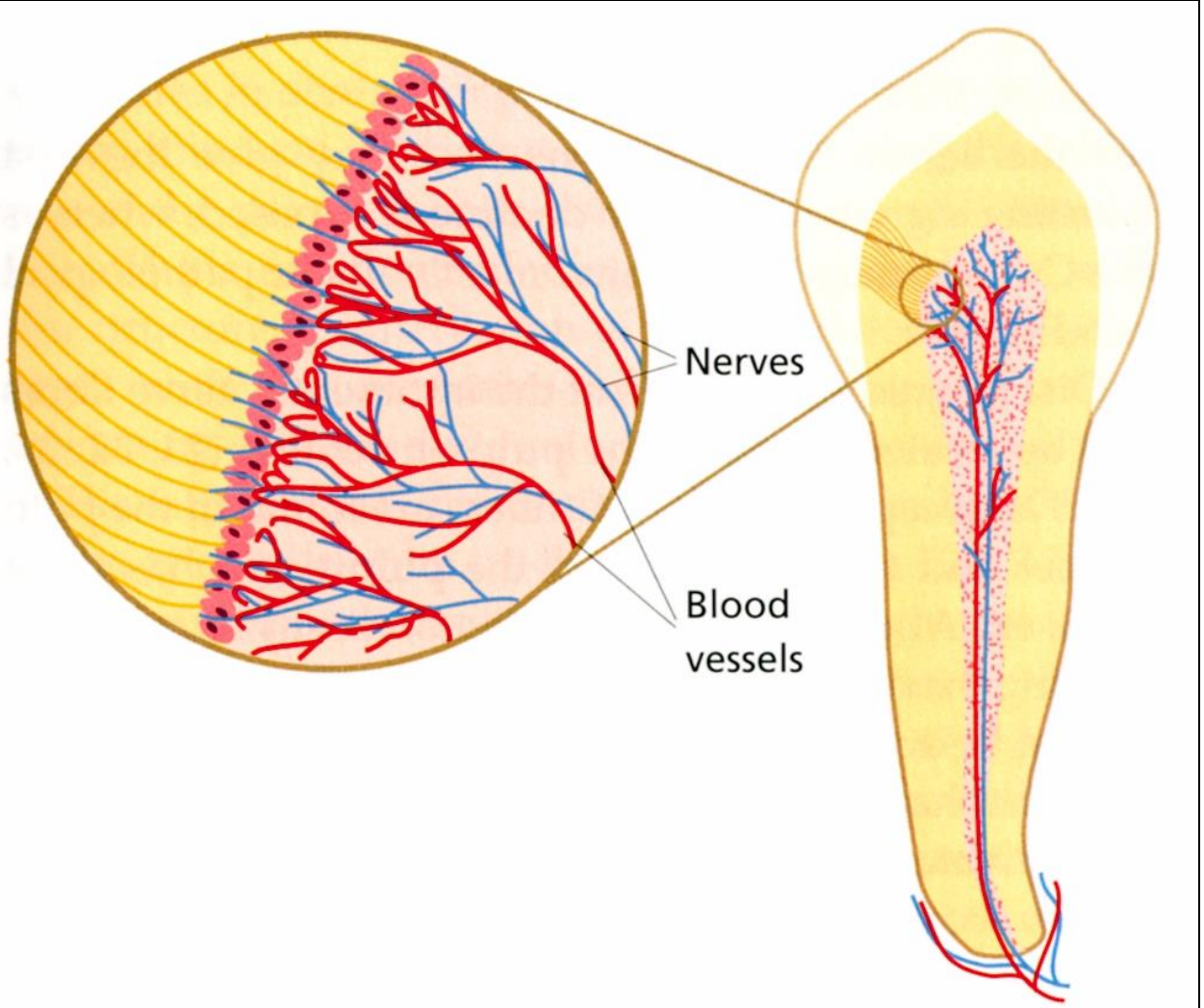


Fig. 4.3 Innervation of the pulp/dentine border in the coronal pulp. The nerve fibers entering the area form a dense network known as the plexus of Raschkow. The fibers form free nerve endings in the peripheral pulp and in the odontoblast layer. Many nerve terminals are also located in the dentinal tubules. Some fibers branch to innervate the adjacent blood vessels (see text for details).

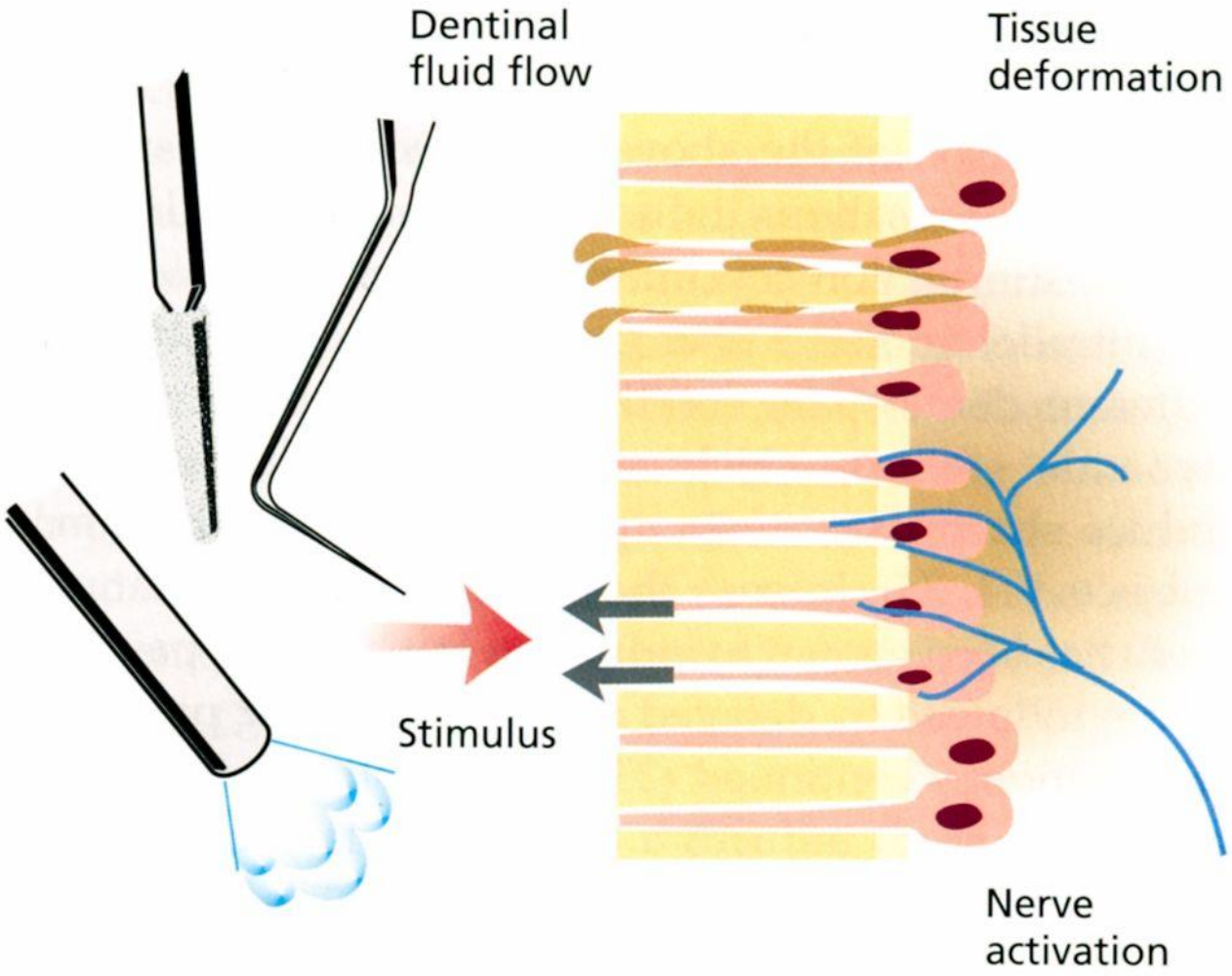


Fig. 4.5 The hydrodynamic mechanism of pulp nerve activation. Any stimulus capable of removing fluid from the outer ends of the dentinal tubules activates hydrodynamic fluid movement. The lost fluid is replaced by an immediate outward flow due to the high capillary forces in the dentinal tubules. The fluid flow causes mechanical distortion of the tissue with the nerve endings in the pulp/dentine border.

Table 3-2. Classification and function of fibers in peripheral nerves

Fiber	Diameter (μm)	Conduction velocity (speed of impulse, m/sec)	Function
A-alpha (α) A-beta (β) A-gamma (γ)	6 to 20 5 to 12	15 to 80 (myelinated) 30 to 70	Afferent fibers for touch, pressure, proprioception, vibration (mechanoreceptors)
A-delta (δ)	1 to 5	2 to 30 (myelinated)	Afferent fibers for pain and temperature
B	1 to 3	3 to 15 (myelinated)	Visceral afferent fibers; preganglionic visceral efferent fibers
C	0.4 to 1.0	0.4 to 2 (nonmyelinated)	Afferent fibers for pain and temperature; postganglionic visceral efferent fibers

Table 3-3. Pain fibers in the pulp (nociceptive/algogenic)

	A-delta (δ) fibers	C fibers
Diameter (μm)	2 to 5 Measurement of parent fiber, which includes myelin sheath; smaller terminal processes (telodendrites) emerge from parent fiber.	0.3 to 1.2 Remain this diameter throughout their length
Conduction velocity (m/sec)—speed of electrical impulse or action potential traveling along nerve	5 to 30 As many as eight smaller terminals (telodendrites) feed into one larger myelinated parent fiber to produce greater velocity because of increased diameter.	0.4 to 2
Myelinated	Yes—parent axons located in cell-rich and central zones No—myelination lost by terminal branches of parent axon in dentinoblastic and subdentinoblastic zones	No Jelly roll spirals of Schwann cell membranes are absent. Fibers are enveloped by Schwann cells but not with myelin.
Location of terminals	Superficial—terminals in dentin tubules in dentinoblastic and subdentinoblastic zones (pulp-dentin border zones)	Probably near blood vessels throughout pulp; small C fibers difficult to differentiate from other cell processes.
Pain characteristics	Sharp, pricking and unpleasant but bearable (fast and momentary)	Throbbing, aching, and less bearable; lingering and extremely unpleasant sensation
Stimulation threshold	Relatively low—doesn't take much to initiate (fire) an impulse; can be stimulated without injury to tissue	High stimulation threshold to stimulate these fibers; stimulus may have to be so intense that tissue is damaged; from a pathologic standpoint, pain is associated with inflammatory process (exudative lesion and tissue damage).

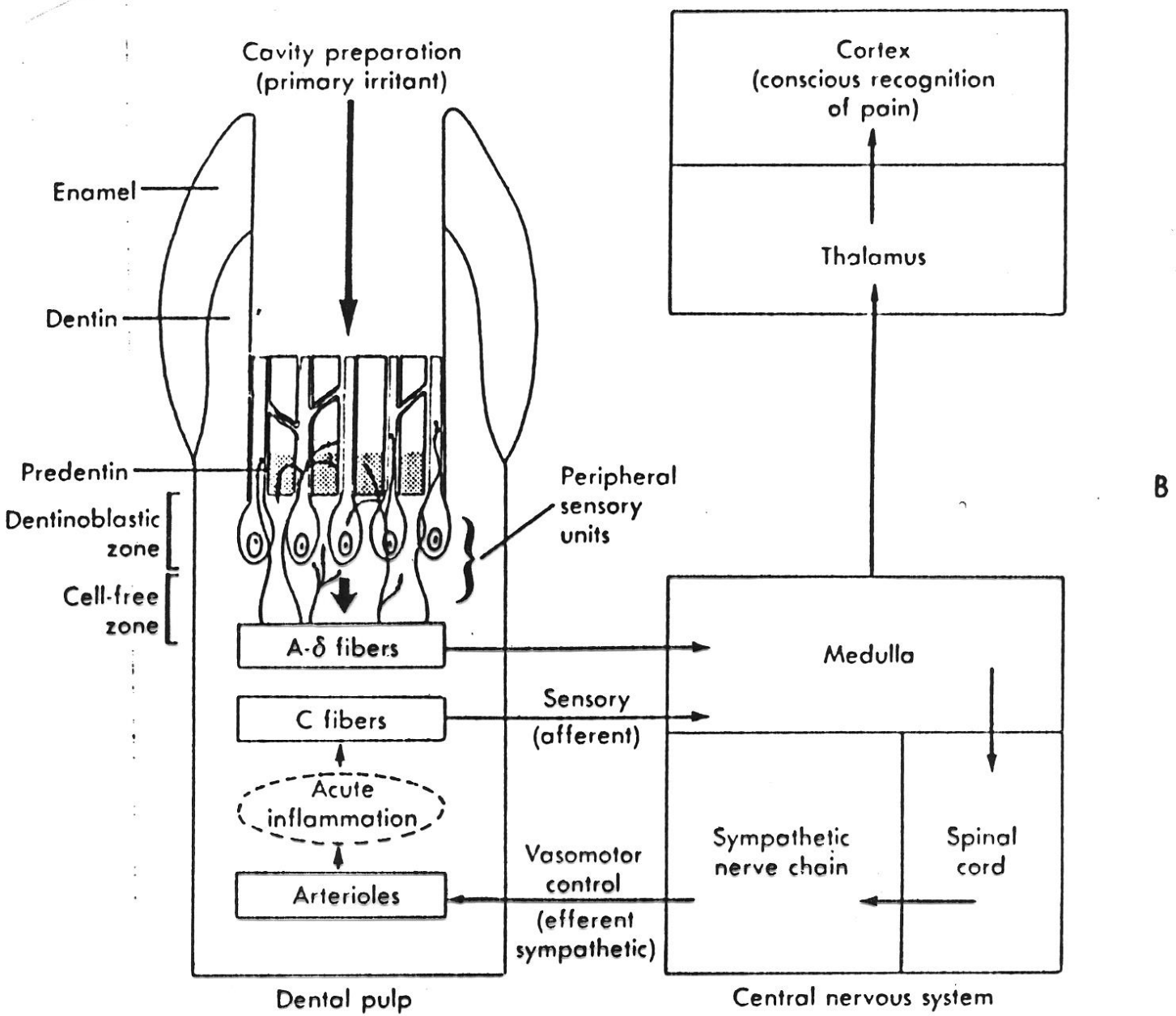


Fig. 3-20, cont'd. **B**, Afferent-efferent pathway for sensory and vasomotor impulses as a result of severe dentinal stimulation.

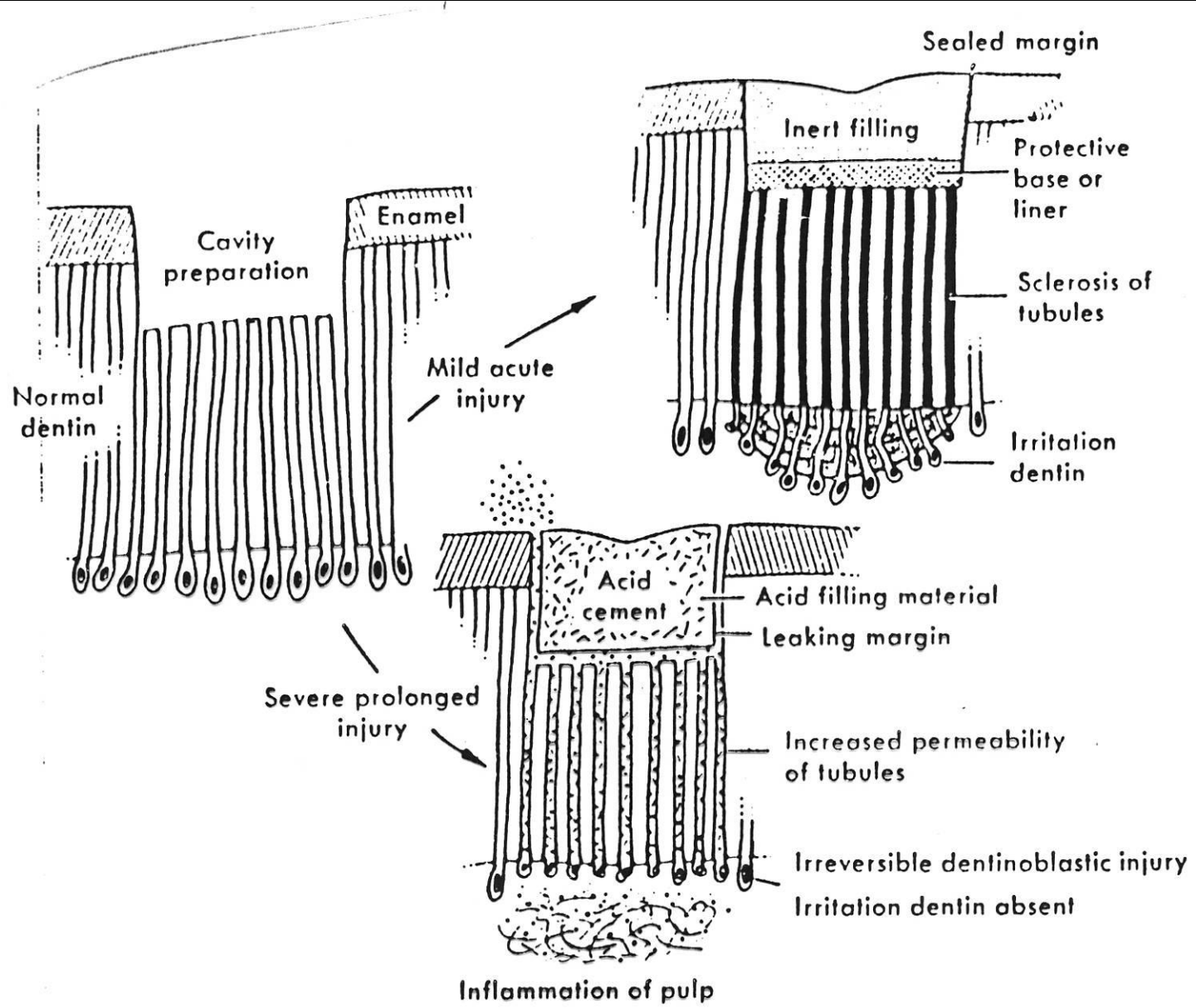


Fig. 3-34. Reaction of pulpodentinal complex to mild and severe injury. Following cavity preparation and insertion of an inert filling, mild acute injury produces tubular sclerosis and irritation dentin. However, severe prolonged injury causes irreversible dentinoblastic injury, which in turn initiates pulpal inflammation. (From Massler, M: Dent Clin North Am, March 1965.)

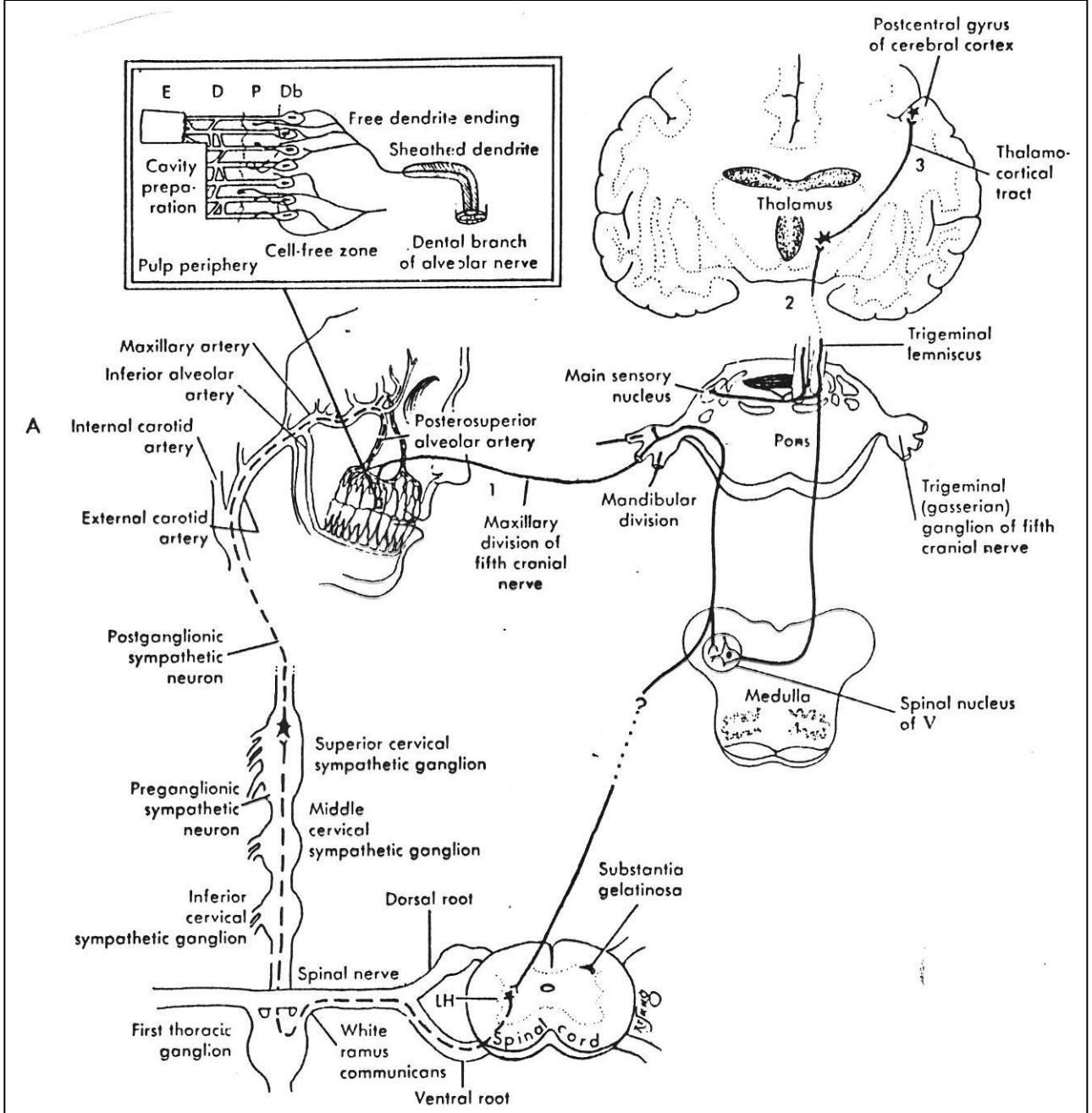
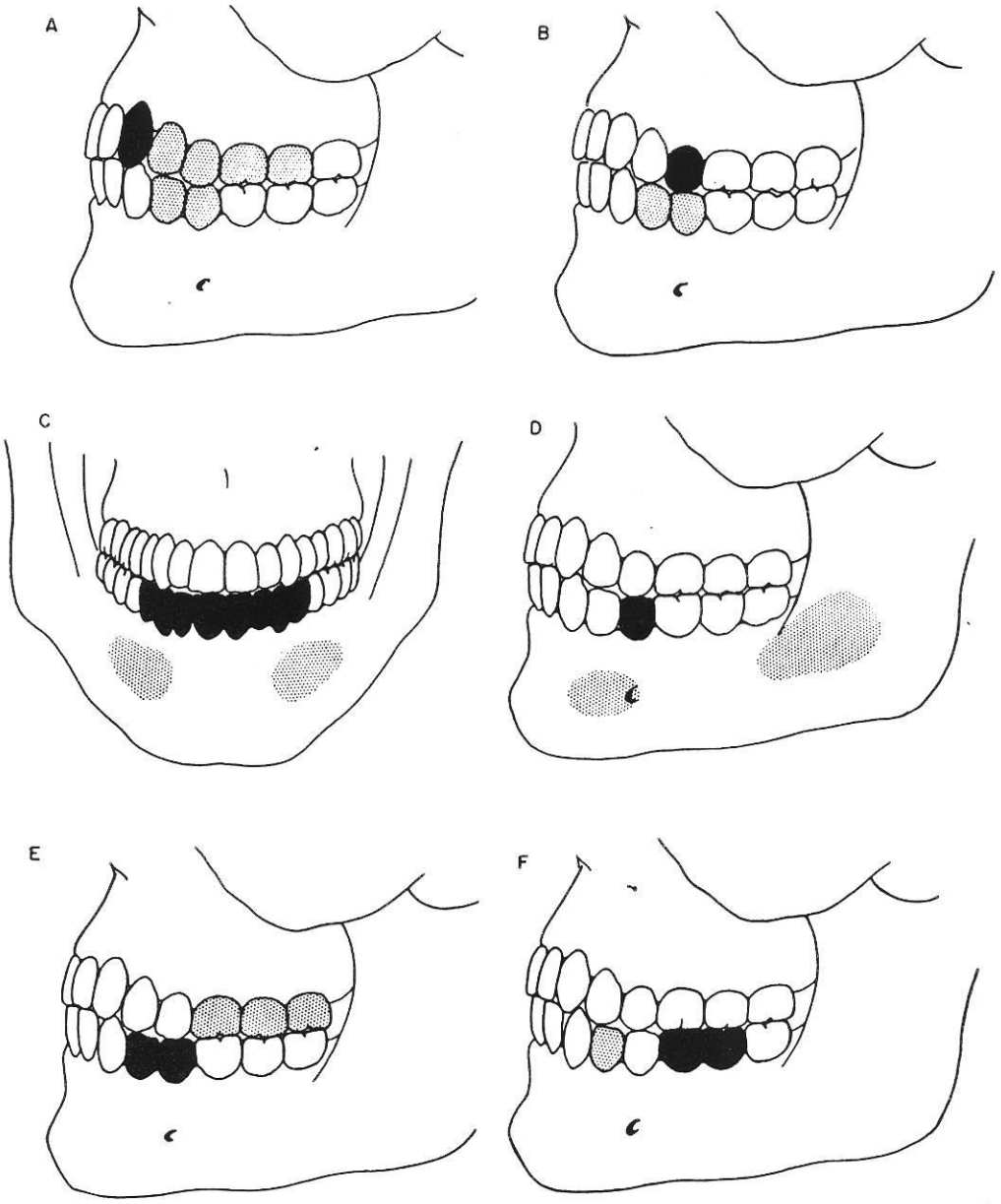
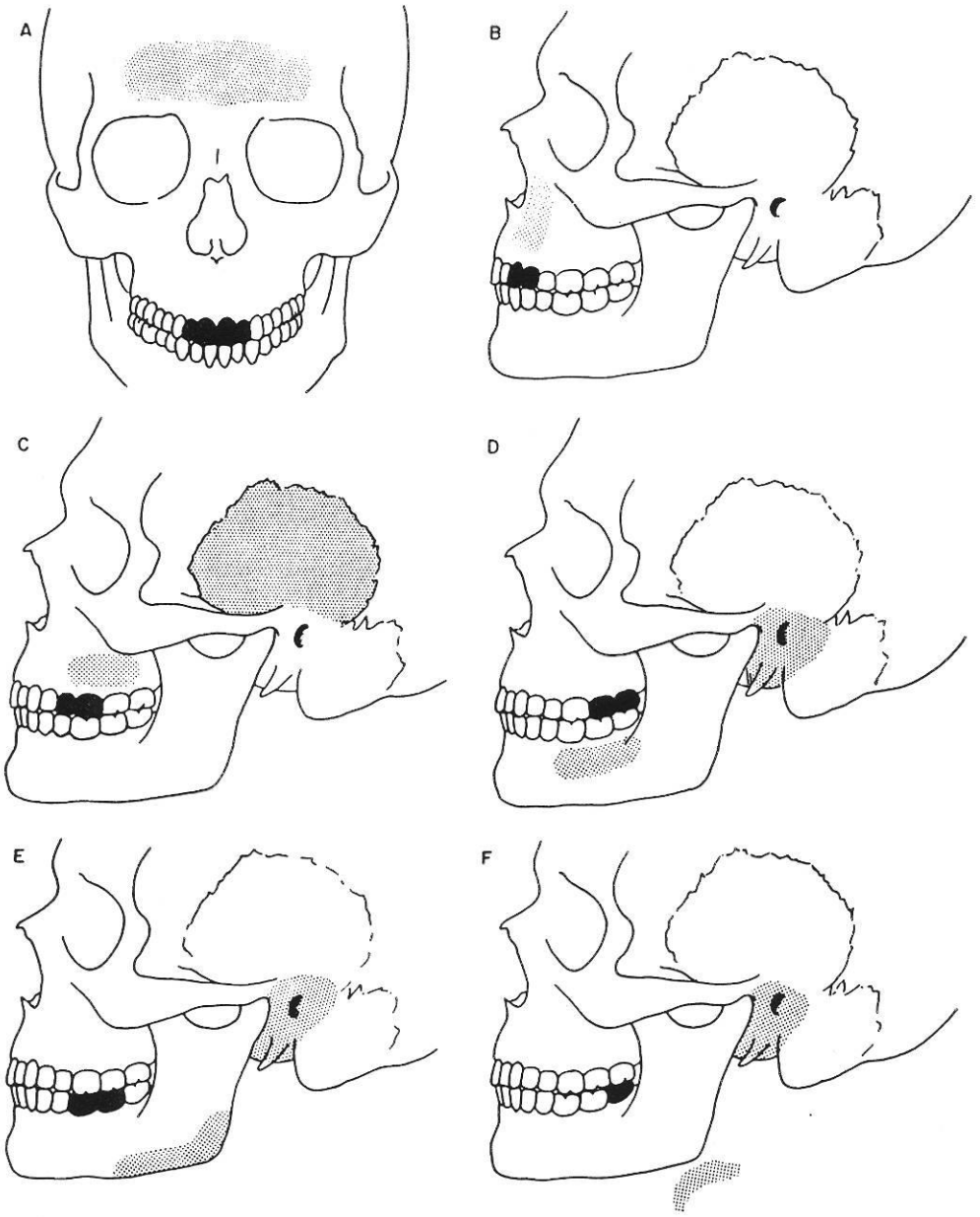


Fig. 3-20. A, Afferent-efferent pathway for sensory and vasomotor impulses. *E*, Enamel; *D*, dentin; *P*, predentin, *Db*, dentinoblast; *LH*, lateral horn (upper thoracic region); -----, efferent nerves; _____, afferent nerves; *1*, *2*, *3*, sensory neuron sequence.



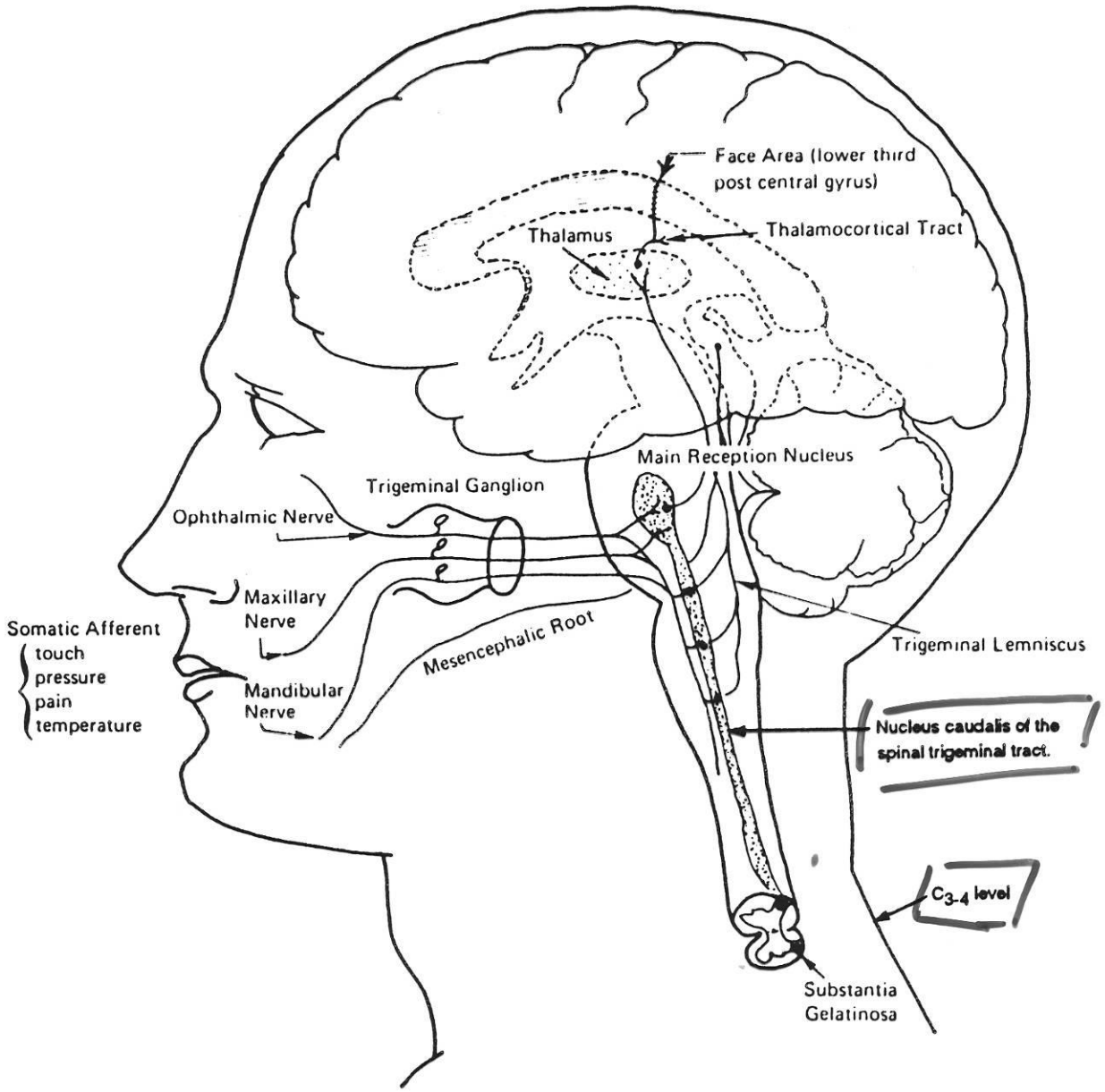
Referred pain pathways from teeth involved with pulpalgia to other teeth as well as to immediate area. ***Black*** signifies tooth with pulpalgia; ***stippled*** areas, site of referred pain. ***A,*** Maxillary canine may refer to maxillary first or second premolars and/or first or second molars; also to mandibular first or second premolars. ***B,*** Maxillary premolars may refer pain to mandibular premolars. Reverse is also true. ***C,*** Mandibular incisors, canine, and first premolar may refer pain into mental area. ***D,*** Mandibular second premolar may refer pain into mental and midramus area. ***E,*** Mandibular first or second premolars may also refer pain into maxillary molars. ***F,*** Mandibular molars may refer pain forward to mandibular premolars. (Adapted with permission from Glick, D.H.: Oral Surg., *15*:613, May, 1962.)



Pain referred from pulpalgia to structures remote from involved tooth. ***Black*** indicates teeth involved in pulpalgia; ***stippled*** areas, remote areas of referred pain. ***A,*** Maxillary incisors may refer pain to frontal area. ***B,*** Maxillary canine and first premolar may refer pain into nasolabial area and into orbit. ***C,*** Maxillary second premolar and first molar may refer pain to maxilla and back to temporal region. ***D,*** Maxillary second and third molars may refer pain to mandibular molar area and occasionally into ear. ***E,*** Mandibular first and second molars may commonly refer pain to ear and to angle of mandible. ***F,*** Mandibular third molar may refer pain to ear and occasionally to superior laryngeal area. (Adapted with permission from Glick, D.H.: Oral surg., *15*:613, May, 1962.)

Table 3-10. Referred pulpal pain

Site of pain referral	Tooth pulp initiating pain
Frontal (forehead) region	Maxillary incisors
Nasolabial area	Maxillary canines Maxillary premolars
Maxillary region above maxillary molars	Maxillary second premolars Maxillary first molars
Temporal region	Maxillary second premolars
Mandibular area below mandibular molars	Maxillary second and third molars
Ear	Mandibular molars Maxillary second and third molars (occasionally)
Mental region of mandible	Mandibular incisors, canines, and premolars
Angle of mandible	Mandibular first and second molars
Midramal region	Mandibular second premolars
Superior laryngeal area	Mandibular third molars
Maxillary premolars	Maxillary canines
Maxillary molars	Maxillary canines Mandibular premolars
Mandibular premolars	Maxillary canines Maxillary premolars
Mandibular first premolar	Mandibular first and second molars



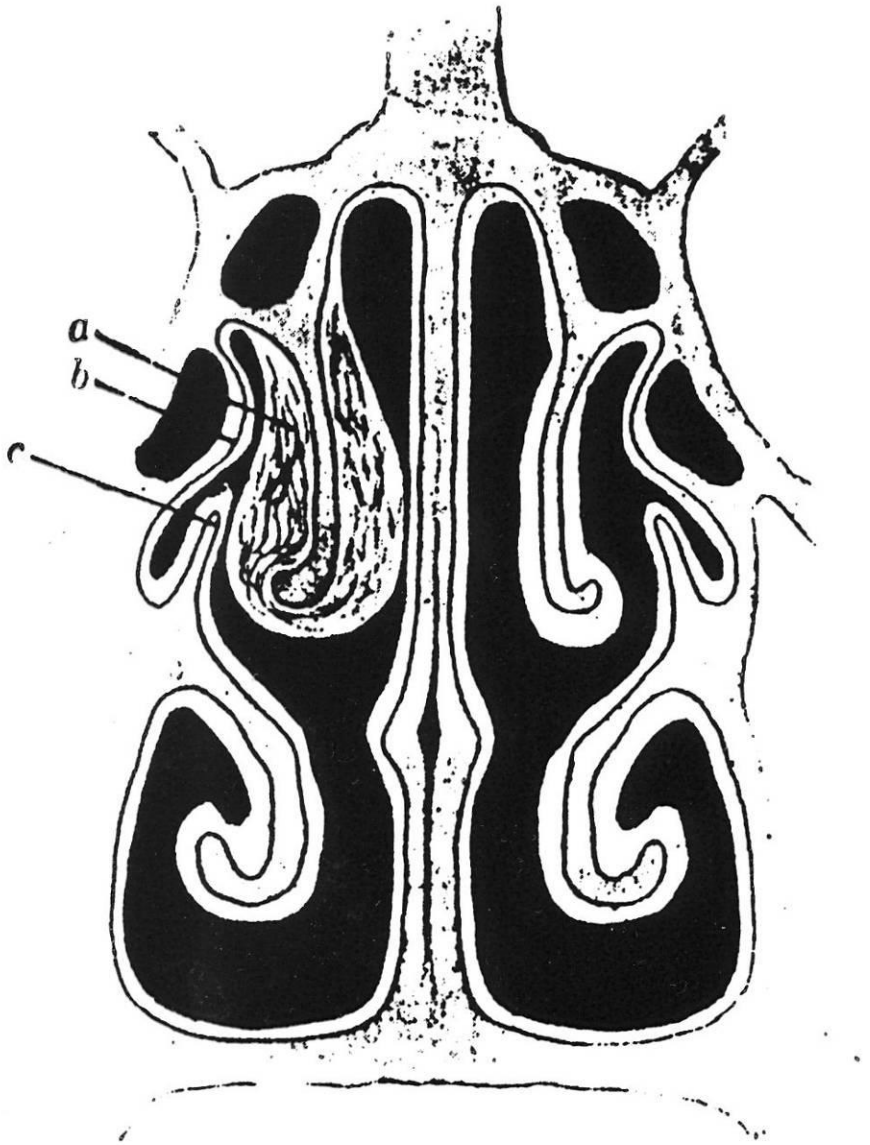
Primary afferent nociceptive fibers of the trigeminal nerve (cranial nerve V) synapse in the nucleus caudalis of the spinal trigeminal tract. The nucleus caudalis descends as low as C3–4 in the spinal cord. Many nociceptors from deep cervical structures synapse on the same second-order pain transmission neurons as the trigeminal nerve. This may explain why cervical pain disorders are often perceived as facial pain or headache.

Local Pathosis of Extracranial Structures

Structures	Diseases
Tooth pulp, periradicular structures	Inflammation
Periodontium, gingiva, mucosa	Infection
Salivary glands	Degeneration
Tongue	Neoplasm
Ears, nose, throat, sinuses	Obstruction
Eyes	

Referred Pain from Remote Pathologic Sites

Structures	Diseases
Heart	Angina pectoris, myocardial infarction
Thyroid	Inflammation
Carotid artery	Inflammation, other obscure causation
Cervical spine	Inflammation, trauma, dysfunction
Muscles	Myofascial trigger points



Inflammation of nasal mucosa causes swelling of turbinate and blocks off ostium of maxillary sinus. Pain referred to maxillary teeth may then develop. (With permission from Ballenger, J.J.: Diseases of the Nose, Throat, and Ear. 11th Ed. Philadelphia, Lea & Febiger, 1969.)