

Cranial Parasympathetic Ganglions and their Relations with Trigeminal Nerve

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Questions

1. Why the cranial parasympathetic ganglions are accompanied the Trigeminal nerve branches (V1, V2, V3)?
2. Why the lacrimal gland receives secretomotor fibers from pterygopalatine ganglion which is located in pterygopalatine fossa via zygomatic branch of V2 to lacrimal nerve of V1 and not receive such fibers from the neighboring ciliary ganglion?

The trigeminal nerve is the largest of the cranial nerves. It originates from the brainstem at the midlateral surface of the pons, near its upper border, by a smaller motor and a larger sensory root. The afferent fibers transmit information from the face, oral and nasal cavities, and most of the scalp. Most of these fibers have their cell bodies located in the trigeminal ganglion or Gasserian ganglion. With the exception of periodontal ligament mechanoreceptors, the cell bodies of the neurons involved in proprioception and the stretch receptors are located in the mesencephalic nucleus. In addition, the trigeminal nerve also contains visceral efferent fibers for lacrimal, salivary and nasal mucosa glands; these fibers come from facial and glossopharyngeal nerves and run into the trigeminal nerve after an anastomosis with a branch of the facial or glossopharyngeal nerves. Somatic efferent fibres of the trigeminal nerve innervate the masticatory muscles. They originate from the motor nucleus of the trigeminal nerve located in the pons.

The trigeminal nerve gives three branches distal to the trigeminal ganglion. The upper branch of the trigeminal nerve is the ophthalmic nerve (V1). It passes forward in the lateral wall of the cavernous sinus and gains access to the orbit via the superior orbital fissure. The ophthalmic nerve gives branches to supply sensation to the eyeball, conjunctiva, lacrimal glands, nasal mucosa, and skin of the nose, eyelid and forehead.

The middle branch is the maxillary nerve (V2). Maxillary division exits the middle cranial fossa through the foramen rotundum and enters into the pterygopalatine fossa where it gives off several branches for the dura, the maxillary teeth and associated gingiva, the maxillary sinus, the upper lip, the lateral surface of the nose, the lower eyelid and conjunctiva, the skin of the cheek and of the side of the forehead, the nasal cavity and the mucosa of the hard and soft palate. Pterygopalatine parasympathetic ganglion accompanied V2 and its secretomotor fibers distributed with V2 branches (to minor salivary glands, nasal glands and lacrimal glands).

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The lower branch is the mandibular nerve (V3). V3 runs along the floor of the cranium then exits through the foramen ovale into the infratemporal fossa and innervates the dura, the craniomandibular joint, the skin over the side of the head above the ears, the auricle, the tongue and its adjacent gingiva, the muscle of the floor of the mouth, the mandibular teeth and associated gingiva, the mucosa and skin of the cheek, the lower lip and the chin and the muscles of mastication. Otic and submandibular parasympathetic ganglions are accompanied V3 and their secretomotor fibers are distributed to the major and minor salivary glands.

Since the mastication process starts by usage of muscles of mastication that supplied by V3. It needs fluid like saliva, therefore, the mastication enhances the salivation process which is a very important to complete the mastication of the foods. During mastication and as a result of odors and types of foods, the salivation also increased.

The lacrimal glands also participate in the process of mastication by stimulation of tears production (as as a sort of protection of the eyes) when the hot food introduced inside the mouth in addition to the type of food such as spices food.

Regarding the question why ciliary ganglion not innervates the lacrimal gland instead of pterygopalatine ganglion? The answer of such question is: Ciliary gland controls the vision process (accommodation).