Pharyngeal Arch Derivatives: 1st Arch

The pharyngeal arches (also known as branchial arches) are a fundamental aspect of vertebrate head and neck development. They are all derived from mesoderm and appear early in the third to fourth gestational week, and differentiate into terminal structures by the seventh to eighth gestational week. They are comprised of cartilage support (serving as a precursor to skeletal elements), arterial supply (from the aortic arch system) and cranial nerve supply. In the first pharyngeal arch, Meckel’s cartilage develops into the mandible, malleus, incus and sphenomandibular ligament. The muscles derived from the first arch include the muscles of mastication, mylohyoid, anterior belly of the digastric, tensor tympani and tensor veli palatini. The cranial nerve (CN) supply to these structures are the maxillary and mandibular branches of the trigeminal nerve, V2 and V3.

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Cartilage

Meckel's Cartilage
Mackerel Cartilage
Meckel’s cartilage contributes to the formation of the mandible, malleus, incus, and sphenomandibular ligament

Mandible
Mandible
The mandible (lower jaw bone) is a U-shaped bone that supports the mandibular teeth. It derives from the anterior and posterior regions of Meckel’s cartilage.

Malleus
Malleus-mallet
The malleus (Latin for hammer) is a small bone in the middle ear that attaches the tympanic membrane to the incus. The malleus functions as a lever and transmits sound vibrations from the tympanic membrane to the incus. It derives from the anterior region of Meckel’s cartilage.

Incus
Incan
The incus (Latin for anvil) is a small bone in the middle ear that attaches the malleus to the stapes. The incus transmits vibrations from the malleus to the stapes. It derives from the posterior region of Meckel’s cartilage.

Sphenomandibular Ligament
Sphinx-mandible Ligament
The sphenomandibular ligament attaches to the spine at the sphenoid bone and the lingula of the mandibular foramen. It acts as primary passive support of the mandible and serves as a fulcrum for the movements of the mandible at the temporomandibular joint (TMJ). The sphenomandibular ligament derives from the middle region of Meckel’s cartilage.

Muscles

Muscles of Mastication
Muscles for Chewing
The muscles of mastication are responsible for chewing and swallowing. They include the temporalis, masseter, and lateral and medial pterygoids. Since these muscles all develop from the first pharyngeal arch, they are all innervated by CN V3 (trigeminal).

Tensor Tympani
Tenor Tympani-drum
The tensor tympani is a short muscle that arises from the superior surface of the pharyngotympanic tube and inserts onto the handle of the malleus. It acts to pull the malleus medially, reducing the amplitude of oscillations, which prevents damage to the internal ear when exposed to loud noises. Since this muscle develops from the first pharyngeal arch, it is innervated by CN V3 (trigeminal).

Tensor Veli Palatini

Tenor Pallet-tins

The tensor veli palatini attaches superiorly at the sphenoid and inserts distally onto the palatine aponeurosis. It acts to elevate the soft palate. Since this muscle develops from the first pharyngeal arch, it is innervated by CN V3 (trigeminal). It is the only muscle of the soft palate that is not innervated by CN X (vagus).

Anterior Belly of the Digastric

Ant-eater on Dyed-digastric

The digastric is composed of two bellies, anterior and posterior, which are connected by a pulley-like tendon. The anterior belly of the digastric inserts on the genu of the mandible and is responsible for depressing the mandible against resistance. Since this muscle develops from the first pharyngeal arch, it is innervated by CN V3 (trigeminal). It is important to note that the posterior belly of the digastric develops from the second pharyngeal arch and is consequently innervated by CN VII (facial).

Mylohyoid

Meal-on-hieroglyph

The mylohyoid attaches proximally to the medial body of the mandible and distally at the hyoid bone. Its action is to elevate the hyoid and the tongue. It is important in speaking and swallowing. Since this muscle develops from the first pharyngeal arch, it is innervated by CN V3 (trigeminal).

Nerves

CN V2

Cranial Nerve 5 with V (2) Tutu

The trigeminal nerve splits into three branches, the ophthalmic (V1), maxillary (V2), and mandibular (V3) branches. The maxillary (V2) nerve branch is primarily responsible for sensory innervation of the face from the lower eyelid to the upper lip, as well as the mucosa of the sinuses.

CN V3

Cranial Nerve 5 with V (3) Tree

The Trigeminal nerve splits into three branches, the ophthalmic (V1), maxillary (V2), and mandibular (V3) branches. The Mandibular (V3) nerve branch is responsible for sensation to the chin and lower lip as well as around the anterior ear up along the scalp. It carries the motor component to the muscles of mastication, mylohyoid, anterior belly of the digastric, tensor tympani, and tensor veli palatini.

Conditions

Treacher Collins Syndrome

Treasure Coins

In Treacher Collins syndrome, neural crest cells fail to migrate into the first pharyngeal arch, leading to mandibular hypoplasia, facial abnormalities, and conductive hearing loss.