Case Report:
Rare Arborization Pattern of the Facial Nerve

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Abstract: The arborization of the extratemporal facial nerve typically begins within the substance of the parotid gland and ultimately gives rise to the cervical, marginal mandibular, buccal, zygomatic, and frontal (or temporal) nerve branches. However, the number and branching pattern of these nerves is variable. Variations of development of the facial nerve are important to consider in surgery since they are vulnerable to trauma during rhytidectomy, parotidectomy, maxillofacial fracture reduction, and almost any surgery of the head and neck. We, therefore, present a case of an unusual branching pattern of the facial nerve with multiple terminal branches and several arcades along its course. The presence of multiple anastomoses is a potential protective factor in case of their damage during surgery.

Key Words: Facial nerve, Dissection, Anatomy.

Introduction:
Neuroanatomy is a complex and constantly evolving field of medicine. Individual variations of the nervous system are of special attention since they often dictate the surgical approach and possibilities. They are also a major source of intraoperative complications. Nevertheless, the anatomy of the peripheral nervous system is relatively understood. This is also true for the nerves of the facial region. The facial nerve is the seventh paired cranial nerve which has motor, sensory and autonomic fibers. It arises from the pons of the brainstem and has an intracranial, intratemporal, and extracranial portion. The extracranial portion of the nerve begins at the point where the nerve exits the cranium via the stylomastoid foramen.(1)

After exiting, the facial nerve gives off two branches; the posterior auricular nerve (supplying the posterior auricular muscle, the superior auricular muscle, and the occipital belly of the occipitofrontal muscle) and the digastic nerve (supplying the posterior belly of the digastic muscle and the stylohyoid muscle). Then the facial nerve enters the parotid gland and divides into two main trunks. These are the superior temporofacial and inferior cervicofacial trunks. These two trunks give rise to the parotid plexus, and from this plexus, five branches emerge. These are known as the temporal (or frontal), zygomatic, buccal, mandibular, and cervical branches, which carry motor fibers to the facial muscles.(1, 2)

The extracranial segment of the facial nerve is especially vulnerable for trauma during rhytidectomy, parotidectomy, maxillofacial fracture reduction, and almost any surgery of the head and neck.(3) It can also be damaged during the inferior alveolar block procedure if the injection goes deep into the gland or the nerve is located superficial.(4) Temporary is seen in 50% of cases after parotid surgery, while 7% end up with permanent facial palsy.(3) Since variations of development of the facial nerve are important to consider in surgery, we present a case of a vast branching pattern of the facial nerve with multiple arcades along its path.

Case Report
The branching pattern of the facial nerve was evaluated in a male (67-year-old) cadaver during a typical dissection at the department of human anatomy. After exiting from the stylomastoid foramen, the facial nerve divided into two branches (Fig. 1). The superior (temporofacial) trunk immediately divided into a large and a small branch. The smaller branch innervated the parotid gland, whereas the large branch divided into two temporal branches, three zygomatic branches, and the superior buccal branch (Fig. 2, 3). The inferior trunk divided into the inferior buccal branch, two mandibular branches, and a large branch that innervated the parotid gland. The inferior mandibular branch gave off a cervical branch. There were multiple vertical and diagonal connections between the branches of the facial nerve. One of the temporal branches formed an arc and two interconnections.
with the zygomatic branch. The zygomatic branches were interconnected by a diagonal branch which continued downward forming a connection with the superior buccal branch. The superior buccal branch had a connection with the lower zygomatic branch and the terminal portion of the superior buccal nerve anastomosed with the terminal portion of the inferior buccal nerve. The inferior buccal nerve had an arc formed by the superior mandibular and inferior buccal branches (Fig. 2, 3). There were two diagonal branches that interconnected the marginal mandibular nerves. A schematic representation of the nerve is present in figure 4.

**Figure 1**: Facial nerve division inside of the parotid gland. 1 - facial nerve trunk 2 - parotid gland, 3 - facial vein.

**Figure 2**: Branches of the facial nerve. T - temporal, Z - zygomatic, B - buccal, M - marginal mandibular, C - cervical.

**Figure 3**: Branches of the facial nerve (a part of the parotid gland has been removed). T - temporal, Z - zygomatic, B - buccal, M - marginal mandibular, C - cervical, P - parotid branches.

**Figure 4**: Schematic representation of the facial nerve.

**Discussion**
The arborization of the extratemporal facial nerve typically begins within the substance of the parotid gland and ultimately gives rise to the cervical, marginal mandibular, buccal, zygomatic, and frontal (or temporal) nerve branches. There have been several attempts to classify the branching patterns...
of the facial nerve. Davis and co-workers dissected 350 cadaveric facial halves and were the first to categorize the branching pattern of the facial nerve into six distinct patterns.(5) Type I - no anastomosis occurred between branches of the facial nerve. Type II - the presence of an anastomotic connection between branches of temporofacial division. Type III - a single anastomosis between the temporofacial and cervicofacial divisions. Type IV was a combination of type II and type III. Type V two anastomotic rami passed from the cervicofacial division to intertwine with the branches of temporofacial division. In the final type VI, there was a plexiform arrangement, where the mandibular branch sent twig to join any members of the temporofacial division.(5) The current case resembles Type IV of facial nerve branching pattern, however, there are several differences particularly the number of branches and the presence of a vast network of anastomosis between the terminal branches. The original study by Davis and co-workers reported VI type in only 6% of their specimens.(5)

Baker and Conley reviewed the extratemporal facial nerve anatomy in 2000 parotidectomy cases. Their findings also suggested that the facial nerve branching pattern was more variable than that noted in Davis’s cadaveric studies. The number of branches and the presence of anastomosis are important for several procedures. For instance, the marginal mandibular and frontal branches of the facial nerve, are more susceptible to injury following parotidectomy, rhytidectomy, or fixation of the mandible at the subcondylar region, ramus, and angle.(6)

The presence of anastomosis between individual terminal branches of the facial nerve is reported in 32.5–70% of cases.(6, 7) However, these are typically isolated anastomoses between two or three branches, and a plexus formed by the branches of the nerve is reported in rare cases.

Lineaweaver and co-workers observed the following prevalence of anastomoses among the terminal branches: temporal-zygomatic anastomoses are found in 88% of cases, zygomatic-buccal in 47%, buccal-mandibular in 88%, and marginal mandibular-cervical anastomoses in 76% of cases.(8) Numerous anastomoses are usually present between the temporal branch above the zygomatic arch.(9) Similarly in a microscopic dissection, multiple vertical anastomoses may be present between the upper buccal, lower buccal, and marginal mandibular branches in addition to the main anastomosis between the lower zygomatic and upper buccal branches.(10)

Therefore, it is important to consider the number of terminal branches, connections between branches or with other cranial nerves to avoid injuries to the facial nerve during surgery.(2) The current case demonstrates that anatomical variations are essential and should be carefully evaluated in order to avoid potential intraoperative complications.(11)

Conclusions
The current case demonstrates that the facial nerve can form a wide plexus with multiple arcades providing a vast anastomotic net. It also serves as a protective factor in case of nerve injury at the level of terminal branches.

References