FACIAL NERVE ANATOMY

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ABSTRACT . Facial nerve monitoring has been increasingly routinely used as an intraoperative adjunctive method to help the head and neck surgeon to identify and minimize facial nerve injury during parotid surgery. The goals, current applications, recent technical advances, and limitations of the method are reviewed. A main focus of this chapter is a review of several prospective clinical trials that have been performed in recent years that have analyzed the benefit of electrophysiological nerve monitoring during parotid surgery. It has been demonstrated that nerve monitoring reduces the risk of early postoperative facial nerve dysfunction in primary surgery, but not in revision surgery. The effect is more pronounced in total than in superficial parotidectomy. Monitoring is associated with shorter surgical times in primary superficial parotidectomy compared to total parotidectomy. Facial nerve stimulation at the completion of parotidectomy helps to prognosticate the facial nerve functional outcome. A lower postdissection to predissection ratio of the maximal response amplitude is associated with early postoperative facial dysfunction. Facial nerve monitoring also helps the surgeon to avoid facial nerve injury when the facial nerve is not exposed during parotid surgery, such as during extracapsular dissection of a parotid neoplasm or sentinel node biopsy.

Methods

The facial nerve, the seventh cranial nerve, is of great clinical significance to oral health professionals. Most published literature either addresses the central connections of the nerve or its peripheral distribution but few integrate both of these components and also highlight the main disorders affecting the nerve that have clinical implications in dentistry. The aim of the current study is to provide a comprehensive description of the facial nerve. Multiple aspects of the facial nerve are discussed and integrated, including its neuroanatomy, functional anatomy, gross anatomy, clinical problems that may involve the nerve, and the use of detailed anatomical knowledge in the diagnosis of the site of facial nerve lesion in clinical neurology. Examples are provided of disorders that can affect the facial nerve during its intra-cranial, intra-temporal and extra-cranial pathways, and key aspects of clinical management are discussed. The current study is complemented by original detailed dissections and sketches that highlight key anatomical features and emphasise the extent and nature of anatomical variations displayed by the facial nerve.

Results

Idiopathic facial paralysis is the most common type of facial nerve injury, accounting for approximately 70% of peripheral facial paralysis cases. This disease can not only lead to a change in facial expression but also greatly impact the psychology of patients. In severe cases, it can affect the normal work and life of patients. Therefore, the research on facial nerve injury repair has important clinical significance. In order to study the mechanism of this disease, it is necessary to carry out relevant animal experiments, among which the most important task is to establish an animal model with the same pathogenesis as human disease. The compression of the facial nerve within the petrous bone, especially the nerve trunk at the junction of the distal end of the internal auditory canal and the labyrinthine segment, is the pathogenesis of idiopathic facial paralysis. In order to simulate this common disease, a compression injury model of the main extracranial segment of the facial nerve was established in this study. The neurological damage was evaluated by behavioral, neuroelectrophysiological, and histological examination. Finally, 50 g constant force and 90 s clamp injury were selected as the injury parameters to construct a stable idiopathic facial paralysis model.

Interpretation

Insufficient recovery after injury of a peripheral motor nerve is due to (1) inappropriate pathfinding as a result of axonal regrowth to inappropriate targets, (2) excessive collateral axonal branching at the lesion site, and (3) polyinnervation of the neuromuscular junctions (NMJs). The rat facial nerve model is often used because of its simple and reliable readout to measure recovery of function (vibrissal whisking). Over the last decades scientists have concentrated their efforts to combat mostly NMJ polyinnervation, because it turned out to be very difficult to reduce collateral axonal branching and impossible to navigate thousands of axons toward the original fascicles. In the past, several groups of scientists concentrated their efforts to reduce the activity-dependent polyinnervation of NMJs by electrical stimulation of the muscles (square 0.1 msec pulses at 5 Hz). The results showed no recovery of functions and a severe reduction in the number of innervated NMJs to approximately one fifth of those observed in intact animals. More recent experiments, however, have shown that motor recovery improved significantly following mechanical stimulation of the denervated facial muscles (vibrissal and orbicularis oculi) and that restored functions could invariably be linked to reduced polyinnervation at the NMJ while the number of innervated NMJ remained the same. These results suggest that clinically feasible and effective therapies could be developed and tested in the near future. Anat Rec, 302:1287-1303, 2019. © 2019 Wiley Periodicals, Inc.

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