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Facial Reanimation Surgery

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Abstract:
Facial palsy is a devastating condition with functional and esthetic sequelae resulting in profound quality of life impairment. When acquired, the inciting insult typically results in acute flaccid facial palsy (FFP). Depending on the degree of neural injury, ultimate outcomes range from persistent and complete FFP to full return of normal function.

Keywords: *Facial Palsy, Static, Dynamic technique*

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I. Introduction

Surgery for facial palsy is one of the most challenging procedures because of its physical and psychological implication. One has to address both the static and dynamic functions of facial nerve. At the same time, one should also take care of the speech, oral incontinence, poor social connection, repeated biting of buccal mucosa and last but not the least the overall confidence of the patient. The incidence of facial palsy is around 30 cases per 1 lakh population per year.1 Bell's palsy is the most common cause of facial palsy in adults. Most of the patients recover completely from Bell's palsy except few. Various options are there to treat the above physical and functional limitation of facial nerve dysfunction.

Anatomy of the Facial Nerve

The precentral gyrus emits the voluntary motor portion of the facial nerve, where most of these nerve fibers cross in the pontine region to approach the facial nerve nucleus in the contralateral pons. At the cerebellopontine angle (CPA), the facial nerve is near the nervus intermedius and the eighth cranial nerve. (Fig. 1)

Intra temporal facial nerve

The first branch of the facial nerve is the greater petrosal nerve, which departs from the geniculate ganglion and is responsible for parasympathetic secretion of the nose, mouth, and lacrimal gland. The nerve to the stapedius is the next branch and arises from the proximal mastoid segment. The chorda tympani nerve emerges proximal to the stylomastoid foramen and carries parasympathetic secretory fibers to the submandibular and sublingual glands, as well taste fibers to the anterior two thirds of the tongue.

Extratemporal facial nerve

The extratemporal branching of the facial nerve has myriad patterns and variations. Dingman and Grabb present the largest dissection-based series for the surgical anatomy of the marginal mandibular branch, while Pitanguy identifies the course of the temporal branch.

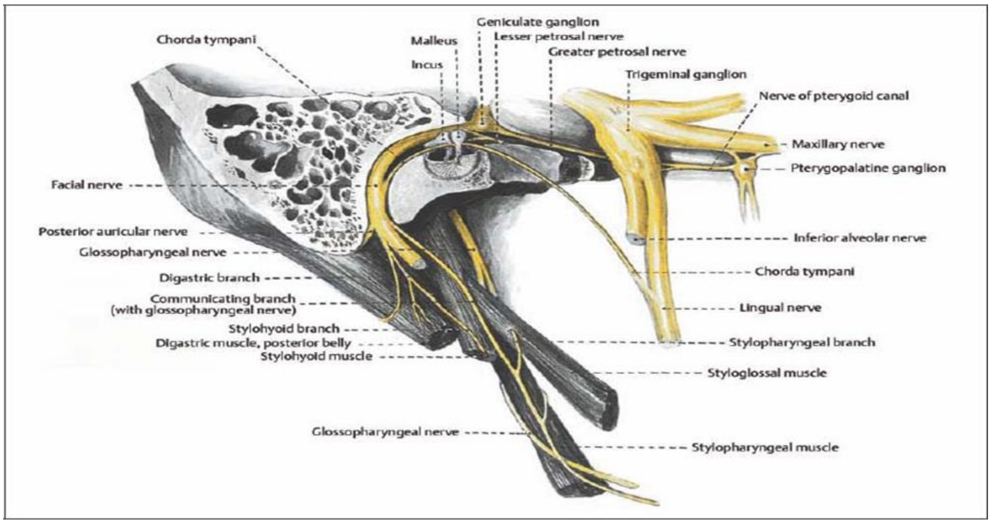

Fig. 1 – Facial Nerve

Etiology of facial palsy

Facial nerve damage leads to both functional and cosmetic deficits. The goals of facial reanimation are to restore facial symmetry, restore voluntary control of the facial musculature, allow the patient to express emotion via the facial musculature, protect the eye, and provide oral continence. Facial paralysis manifests as a spectrum of conditions, presenting as either unilateral or bilateral, and ranging from partial to complete weakness. Etiology is either congenital or acquired, the latter including neoplasms, trauma, infection, and iatrogenic and idiopathic causes.

Diagnosing the stage of facial palsy

House Brackman scale

It is a facia l nerve grading system, at one end of the scale there is normal facial nerve function and at other there is complete paralysis

Grade	Functional Level	Symmetry at Resr	Eye(s)	Mouth	Forehead
I	Normal	Normal	Normal	Normal	Normal
II	Mild	Normal	Easy and complete closure	Slightly asymmetrical	Reasonable function
III	Moderate	Normal	With effort, complete closure	Slightly affected with effort	Slight to Moderate movement
IV	Moderately Severe	Normal	Incomplete Closure	Asymmetrical with maximum effort	None
V	Severe	Asymmetry	Incomplete Closure	Asymmetrical with maximum effort	None
VI	Total Paralysis	Total Paralysis			

Goals of treatment

Reanimation of the paralyzed face focuses on restoration of form and function; it is an immense reconstructive challenge necessitating multidisciplinary management. The goals are to achieve protection of the eye, facial symmetry at rest, voluntary symmetric facial movement and to restore involuntary mimetic facial expression.

II. Surgical Treatment

Primary Neurorrhaphy

When the proximal and distal cut stumps of the facial nerve are available for repair, acute injuries to the extratemporal facial nerve should be repaired as early as possible to facilitate identification of the transected nerve stumps. After 72 hours, the neurotransmitter stores required for motor end plate depolarization are irreversibly depleted and the target muscles no longer respond to stimulation of the distal nerve stump. A tension-free end-to-end repair is the ‘‘gold standard’’ technique. Nerve grafts are indicated when the proximal and distal cut stumps of the facial nerve are clearly identifiable but the intervening gap is too wide to effect a tension-free repair. Once the facial nerve stumps have been dissected and trimmed to the level of healthy fascicles, the nerve may be repaired in an end-to-end fashion with an interposed free nerve graft. The sural, greater auricular nerve and medial antebrachial cutaneous (MABC) or lateral antebrachial cutaneous (LABC) nerve are all acceptable donors. Our current preference is the anterior branch of the MABC. The facial nerve has a variable spatial arrangement, which has direct clinical implications.The internal topography of the facial nerve becomes less complicated as it proceeds peripherally, and even though the senior author has acutely repaired transected nerve branches medial to a perceived line drawn from the lateral corner of the eye to the lateral corner of the lip with excellent success, facial function tends to recover spontaneously in injuries to this region. In addition, individual facial muscle fibers can possess multiple motor end plates that arise from different branches of the facial nerve. This duplicity in innervation and more consistent facial nerve topography lead to a greater degree of recovery with more medial, or peripheral, injuries and also contribute to greater success with nerve repair. In some cases, dormant branches of the trigeminal nerve may reinnervate denervated facial muscles as seen in rare cases of delayed spontaneous return of facial animation without surgical intervention. Facial nerve repair is frequently complicated by synkinesis or dyskinesis. Synkinesis is defined as the abnormal, simultaneous contraction of a group of muscles with voluntary or involuntary facial expression. This phenomenon occurs when regenerating axons innervated and unintended targets. Dyskinesis refers to unintended facial muscle contractions that occur when axons inappropriately innervate the intended target. These phenomena are more likely to occur with more proximal injuries to the facial nerve, especially intratemporal injuries.

Cross-Facial Nerve Graft

When the proximal facial nerve stump is unavailable for primary repair, the reconstructive surgeon may employ a cross-facial nerve graft. Axons from the contralateral facial nerve are diverted to the injured distal facial nerve stump via a free nerve graft. Selecting a donor nerve with function similar to and synchronous with that of the injured nerve, such as the contralateral facial nerve, leads to a natural functional outcome and minimizes synkinesis. Branches of the contralateral facial nerve are exposed through a standard preauricular incision, and nerve stimulation identifies branches of the contralateral facial nerve that may be sacrificed without incurring functional deficits on the donor side. Usually, one or two nerve branches that cause elevation of the oral commissure and upper lip are chosen while protecting the branches that will preserve eyelid function. Next, the severed branches of the donor nerve are coapted in an end-to-end fashion with the free nerve graft, which is usually the sural nerve based on its caliber, length, and expendability. A subcutaneous tunnel is created across the upper lip, and the nerve graft is delivered to the contralateral side. If this procedure can be done shortly after the initial injury, the distal nerve graft may be coapted to the contralateral facial nerve branches at this time, but it is otherwise banked in the preauricular region in preparation for a free muscle transfer.

Nerve Transfers and Partial Nerve Transfers

Facial nerve defects that are not amenable to repair using the ipsilateral or contralateral facial nerve must rely on innervation from an alternative source. Earlier techniques sacrificed an adjacent nerve, such as the hypoglossal, to provide regenerating axons for the distal facial nerve stump. However, donor morbidity is high when the entire donor nerve is used and includes swallowing and speech problems and tongue hemiatrophy. Additional morbidity arises from activation of the donor nerve's original target muscles to stimulate the reinnervated facial muscles. Following hypoglossal-facial nerve transfers, patients need to manipulate their tongues to activate the neurotized facial muscles and may develop synkinetic facial movements with speech, eating, and other tongue movements. Other donor nerves have also been used including the trigeminal and spinal accessory nerves, but their use has also resulted in gross, dyskinetic facial movements. However, with time, some patients with appropriate therapy and motor reeducation develop the ability to contract reinnervated facial muscles independently and spontaneously without consciously activating donor nerve function. To minimize donor morbidity, partial hypoglossal nerve transfer using up to 25% of the nerve has been described with adequate reinnervation of facial muscles and no appreciable loss of tongue function or bulk or speech deficits.The ipsilateral hypoglossal nerve is exposed proximally where it has been shown to have a monofascicular pattern and then dissected distally where it develops a polyfascicular pattern. An end-to-side neurorrhaphy is employed using an interposition nerve graft, usually the MABC, and a partial neurectomy in the hypoglossal nerve is performed to facilitate regeneration across the end-to-side repair. Care is taken to preserve fascicles of the hypoglossal nerve innervating the posterior aspect of the tongue. Nerve transfers have also been used to provided temporary trophic support to the denervated neuromuscular junction if a prolonged period of denervation is anticipated such as in reconstructions using a cross-facial nerve graft and free muscle transfer. Such ''babysitter'' procedures have been described utilizing both the hypoglossal and accessory nerves.32 However, the efficacy of this technique has been questioned in the animal model, which suggests that recovery of muscle function is superior after a single prolonged period of denervation followed by a single reinnervation rather than repeated episodes of denervation followed by reinnervation. As well, the patient is often reluctant to lose the result from the so-called baby-sitter procedure that is sacrificed in the hope of a better result.

III. Surgical Management Of Established Facial Palsy

Regional Muscle Transfers

When facial musculature has been denervated for more than a year, motor end plates are usually irreversibly lost, and surgical attempts at reinnervation are usually futile. A patient's resulting deficits, general medical condition, and expectations all play a role in determining the most appropriate surgical procedure at this point. If the patient does not wish to have multiple procedures or will not medically tolerate a prolonged anesthetic, a regional muscle transfer is a good choice for restoring voluntary facial movement. The temporalis and masseter muscles are most commonly chosen for regional transfer, utilizing either a portion of the muscle or the entire muscle, or sometimes both muscles may be used if the natural vector of the patient's smile is in a more lateral direction. We most commonly use a partial temporalis muscle transfer. The vector generated by the transferred muscle extends from the modiolus to the anterior zygomatic arch and resembles the vector created by contraction of the zygomaticus major muscle. The temporalis muscle is mobilized through a preauricular incision extending cephalad over the temporalis. A superiorly based flap of deep temporal fascia 4 cm in width with its cephalic attachment to the muscle reinforced with suture is used to extend the reach of the transfer and provide a means of securing the muscle distally to the modiolus and orbicularis oris. The temporalis is mobilized to the superior border of the zygomatic arch, and insetting is the same as for a free muscle transfer using nonabsorbable clear sutures placed in the orbicularis oris muscle above, below and at the modiolus. An intraoral splint is used to support the oral commissure on the affected side postoperatively for 6 weeks. The senior author has found the temporalis muscle transfer to be a very reliable alternative to microsurgical reconstruction in restoring facial function after prolonged denervation. The success of the procedure depends on the patient's ability to contract the temporalis independently on the affected side to match the degree of facial muscle contraction on the normal side. Although involuntary facial contractions are rarely symmetric, our experience has demonstrated that appropriate patients do extremely well with postoperative therapy and motor reeducation.

Free Tissue Transfers

Regional muscle transfers, like nerve transfers, mandate an element of synkinesis to activate the transferred muscle. Free tissue transfers may avoid these problems if the patient is medically and psychologically tolerant of longer and multiple procedures. Ipsilateral nerves and free cross-facial nerve grafts may provide innervation for free muscle transfers. Alternatively, some free tissue transfers have a neural pedicle with sufficient length to reach the contralateral facial nerve. Donor muscles for free tissue transfer have included the gracilis, latissimus dorsi, pectoralis minor, and rectus abdominis. Free tissue transfers may require either one or two stages. Use of cross-facial nerve grafts, due to the extensive amount of time required for axonal elongation across the graft, has conventionally required two stages. First, a cross-facial nerve graft is coapted to the donor nerve and tunneled to an area near its intended target. A period of 6 to 8 months is required for axons to regenerate across the nerve graft, at which point a free tissue transfer is performed. The neural pedicle of the transferred muscle is coapted to the distal end of the axon-rich cross-facial nerve graft. Our current preference is to perform a crossfacial nerve graft procedure followed by a vascularized free gracilis muscle transfer 8 months later. The gracilis muscle is preferred because of its expendability, ease of harvest, parallel fiber orientation, and reasonable length of excursion with contraction. The latissimus dorsi muscle with its longer neurovascular pedicle is useful in facial palsy reconstruction when a long pedicle is preferred, for example, with associate facial trauma. The gracilis muscle is trimmed for appropriate tension, anchored proximally to the zygomatic arch and overlying fascia, and inset distally to the orbicularis oris at the oral commissure as described previously for the temporalis muscle transfer.

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