Multimodality Approach to Management of the Paralyzed Face

Tessa A. Hadlock, MD; Laura J. Greenfield; Mara Wernick-Robinson, PT; Mack L. Cheney, MD

Objectives: Despite the ability of facial reanimation techniques to introduce meaningful movement to the paralyzed face, dynamic methods do not address all zones of the face. Our objective was to retrospectively review outcomes after multimodality management of the patient with facial paralysis, to describe several novel surgical methods that introduce subtle improvements in static facial balance, and to present an algorithm for comprehensive management of the paralyzed face. Methods/Results: Three hundred thirty-seven patients with facial paralysis were seen and treated in a busy facial nerve center setting over a 3-year period using a range of standard muscle transfers, physical therapy, chemodenervation with botulinum toxin, and static surgical techniques. Three adjunct techniques emerged as novel and useful procedures that more fully addressed facial balance issues than existing techniques. Of patients proceeding with physical therapy, greater than 80% of patients experienced a benefit, and 97% of those who proceeded with botulinum toxin therapy experienced a benefit. Conclusions: Facial paralysis is best managed using a multimodality approach that includes surgical interventions, physical therapy, and chemodenervation. We describe three adjunctive surgical techniques for management of the paralyzed face and present a comprehensive algorithm for management of the paralyzed face. That may provide improved function and cosmesis in all zones of the paralyzed face. Key Words: Facial paralysis, Bell's Palsy, chemodenervation, botulinum toxin, brow ptosis, fascia lata sling, cross-face nerve graft.


INTRODUCTION

Facial paralysis presents an exceedingly complex management problem. Potential for regeneration varies widely, and accurate prognostic indicators of spontaneous recovery do not exist. This complicates decisions regarding reanimation, because certain techniques interfere with or actually preclude spontaneous recovery processes. Over the past several decades, strategies for reanimation of the paralyzed face have become multifaceted with pharmacologic and physical therapy and surgical components. The past 3 decades have seen a shift in attention away from static repositioning techniques toward the restoration of dynamic function through regional and free muscle transfer.

Given these advances, it is possible to overlook the benefit of simple static techniques during the waiting period for potential facial nerve. Recognizing the shortcomings of dynamic reanimation in certain facial zones, we highlight the role of several specific static interventions, including modified unilateral brow lift and nasolabial fold alteration. They represent a combination of techniques borrowed from contemporary facial rejuvenation surgery. We also report on the effectiveness of botulinum toxin injections into synkinetic musculature, as well as facial nerve-specific physical therapy, and suggest an algorithm whose employment may prevent overlooking specific aspects of the clinical picture.

PATIENTS AND METHODS

From October 2002 through August 2005, 337 patients with facial paralysis, segmental, partial, or complete, were evaluated and treated in a multidisciplinary facial nerve center setting. Those who met criteria for reanimation were offered a range of reconstructive options. Surgical procedures proposed included brow lifting for those with visual field deficits or discomfort resulting from brow ptosis (see subsequently for technique details) and eyelid weighting procedures using thin-profile platinum weights (MedDev, Sunnyvale, CA) for those with incomplete eye closure with effort. Midfacial muscle transfers were proposed for individuals with no meaningful commissure excursion on smiling, even if there was good resting tone on the affected side (see reference 2 for a detailed description of techniques). Static nasal lateralization techniques were offered to those with symptomatic nasal valve collapse based on nasal base rotation toward the nonparalyzed side. Lip and nasolabial fold suspensions, asymmetric facelift, and lower lip muscle transfers (see reference 2 for procedure details) were offered to those with perioral issues, articulation complaints, and oral incompetence. Nonsurgical adjunctive therapy recommendations included specialized facial nerve physical therapy and highly selective chemodenervation with botulinum toxin.

During the course of management, the critical roles of several static procedures and adjunctive therapies to the overall...
result became apparent. The following surgical procedures represent modifications of existing techniques in the facial reanimation or the contemporary cosmetic surgery literature.

**Unilateral Brow Ptosis Correction**

Patients with clinically apparent or bothersome brow asymmetry underwent unilateral brow lifting (Fig. 1). We included patients with isolated frontal branch or upper division facial nerve injury (even in whom regeneration was likely to occur based on primary repair or cable grafting). A powerful brow elevation technique using a biodegradable brow stabilization device (ENDOTINE Forehead; Coapt Systems Inc., Palo Alto, CA) was used.\(^1\)

**Technique.** Preoperative determination of desired brow position is made, and the affected side is infiltrated with local anesthetic. A 1-cm vertical incision is made 1.5 cm posterior to the hairline corresponding to a vertical line drawn from the center of the affected brow. Subperiosteal dissection is carried out along the entire supraorbital rim, avoiding the supratrochlear or supraorbital neurovascular bundles. A fixation hole is drilled into the calvarium and the fixation device inserted. The soft tissues of the forehead are then elevated with a two-pronged skin hook until the desired brow elevation is achieved. The soft tissue is then pressed onto the spikes of the device, securing it in its elevated position. The incision is then closed with interrupted nylon sutures.

**Nasolabial Fold Modification**

Patients with effacement of the nasolabial fold secondary to midfacial paralysis underwent a modification of a recently described two-stitch midface lifting technique (Fig. 2).\(^1\) The technique was applied routinely as a follow-up office procedure 2 months after temporalis muscle transposition. This delayed permitted resolution of perioperative edema so that it would not interfere with the position of the delicate soft tissue stabilizing fascia bolsters responsible for the position of the nasolabial fold. The most accurate way to control final nasolabial fold position was to allow the muscle to heal in position, begin to function in its new location, and then determine the vectors necessary for appropriate nasolabial fold definition.

**Introducing a neonasolabial fold.** A temporal incision is made in the anterior temporal area, exposing the true temporalis fascia (Fig. 2). Four 3 × 3-mm squares of fascia are harvested for use as physiological “pledgets” during the case. Two small nicks are made with a no. 11 blade several millimeters medial to the desired position of the nasolabial fold. A 4-0 Prolene suture is prepared by threading one segment of temporalis fascia onto it, and the Prolene is threaded onto an 11-cm Keith needle (Aspen Surgical Products, Richard Allen, 213401). The needle is passed in through the nasolabial fold nick and out through the temporal incision. The other end of the suture is likewise passed through the nick and out the wound in the temporal region, resulting in tenting of the skin with manipulation of the suture in the temporal incision. The fascial pledget is inserted into the subdermis through the nick. Manipulation of the Prolene allows tethery of the subdermis by pulling the pledget, resulting in pucker at the site of the desired nasolabial. The placement of several Prolene/fascia units allows linear puckering, or “neonasolabial fold.” The temporal incision is closed, whereas the stab incisions in the midface require only Steri-Stripping.

**Effacing an Overprominent Nasolabial Fold**

For patients who have overprominence of the nasolabial fold from aberrant regeneration, a similar technique is used, although the nicks are made 1 cm lateral to the contracted nasolabial fold so that pulling on the Prolene sutures actually effaces the overprominent fold (Fig. 3A). In these cases, a 4-0 Vicryl suture is also threaded onto the Keith needle, as originally described by Keller,\(^1\) avoiding the dermal tethering by the sawing action of the Vicryl suture.
Adjunctive Therapy

For all patients except those with complete, flaccid facial paralysis, physical therapy for the optimization of facial movement and facial balance was prescribed. All patients were treated by a single physical therapist. For patients with synkinesis and hypertonicity, therapy to control and reduce these phenomena was implemented, whereas those who underwent muscle transfer underwent physical therapy to optimize movement of the transferred muscle. The facial grading scale (FGS)\textsuperscript{12} was used at intake and at subsequent follow-up visits for objective assessment of facial function.

Botulinum toxin therapy for chemodenervation of synkinetic muscle fibers and tonically hypercontracted facial musculature was offered in all situations in which synkinesis and hypertonicity were observed. The most frequently injected sites were the ipsilateral orbicularis oculi, platysma, and mentalis muscles, and the contralateral frontalis and depressor labii inferioris muscles. Dosages and injection sites were carefully mapped at each visit, and once a satisfactory regimen was identified, patients returned on a 4- to 6-month basis for retreatment.

RESULTS

Surgical Procedures

Of the 337 patients treated, 88 underwent surgical procedures either before or during the study period. Of those, 44.3\% (39) underwent dynamic reanimation using temporalis, digastric, gracilis, or latissimus dorsi muscle. Of these, there were 15 free and 26 pedicled muscle flaps. Success, defined as meaningful commissure excursion with smiling or biting, was achieved in 85.2\% (75) underwent static procedures, including brow ptosis correction (19), eyelid weight implantation...
(23), nasolabial fold modification (20), static fascia lata sling (19), asymmetric facelifting (22), or combinations of these. Of these, 25 (32.9%) were used to supplement a dynamic reconstruction procedure.

The brow ptosis correction procedures were performed in less than 40 minutes using only local anesthesia; the degree of correction was uniformly satisfactory, and the correction of brow position appears to date to be longlasting. The nasolabial fold modification procedures were able to be performed in an average of 40 minutes using local anesthesia, and resulted in high patient satisfaction and no major complications. There was one instance of Prolene suture extrusion in the temporal area requiring removal.

**Physical Therapy**

There were a total of 111 patients referred for physical therapy. Of these, 74 (66.6%) followed through with the recommendation. Of these, 61 (82.4%) reported subjective improvements in overall facial function, whereas 72 (97.3%) demonstrated objective improvements based on the FGS.

**Chemodenervation**

There were 120 patients who demonstrated significant synkinesis and/or hypertonicity, and all were offered botulinum toxin chemodenervation. Seventy-eight patients (65%) proceeded with chemodenervation therapy, and of these, 76 (97.4%) reported a decrease in synkinesis and/or an improvement in facial symmetry after the injections.

**DISCUSSION**

The management of patients with facial paralysis has undergone many changes over the past 30 years. The advent of microsurgical techniques, the deeper appreciation of neuromuscular physiology and nerve regeneration, and the development of sophisticated biocompatible medical devices has advanced the tools at the surgeon’s disposal. The goal of facial reanimation surgery has evolved from simple corneal protection and oral competence restoration to attempts at balanced, symmetric, mimetic facial movement, restored brow and midfacial position, and lower lip symmetry. Simultaneously, the development of the field of facial rehabilitation and the widespread acceptance of botulinum toxin as an effective chemodenervation method have added to the armamentarium for management of this complex clinical problem.13–15 The need exists for a simple algorithm to synthesize older surgical techniques with newer surgical innovations and to integrate adjunctive therapies into overall facial management.

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**Fig. 4. Proposed algorithm for the management facial paralysis. (A) Acute facial paralysis algorithm. (B) Chronic (longstanding) facial paralysis algorithm.**
Addressing the Face by Region

When examining the patient with a facial nerve disorder, it is tempting to become focused on the most obvious area of asymmetry and thus overlook some of the subtle facial issues whose recognition might lead to more appropriate therapy. We have found it universally beneficial to examine patients with specific regard to five different regions: the brow, the ocular region, the midface and nasolabial fold region, the oral commissure region, and the lower lip.

Once the areas of asymmetry or dysfunction are identified, the region is classified as to whether there is flaccidity or hypertonicity (contracture). Then, a plan is developed according to the algorithm shown in Figure 4A and B. Each case is individualized, although the systematic nature of the algorithm allows us to not overlook reestablishment of balance in any one facial area. An area of significant controversy involves the time course of interventions after the onset of facial paralysis, because in many situations, the time course of recovery is unpredictable. For those with sudden-onset paralysis attributed to Bell palsy, Ramsay Hunt syndrome, or Lyme disease, the initial recommendation is for eye protection and watchful waiting. Based on our observations, those with no clinical signs of recovery after 10 weeks tend to lag significantly behind those with earlier recovery, and recommendations for either surgical or physical therapy interventions, or both, are often initiated then. In the patient with skull base tumor, in whom the facial nerve is left anatomically intact but is not able to be stimulated at the conclusion of the extirpative procedure, recovery is also delayed. We now use a management algorithm that involves early management of flaccid facial paralysis, except in those with sudden-onset paralysis and clinical evidence of recovery by 10 weeks. We also recommend aggressive adjunctive therapy as well as static brow repositioning and nasolabial fold modification for those with suboptimal recovery beginning 12 to 18 months after infection-related paralysis.

CONCLUSIONS

The management of facial nerve disorders remains a complex entity with no widely accepted algorithm for either interventions or their timing. Based on our experience within a busy tertiary care facial nerve center over a 3-year period, we propose an algorithm that integrates multiple therapeutic modalities in an effective timeframe. We propose that adherence to the elements within this algorithm will decrease the incidence of overlooking deficits in any one facial zone and lead to overall improved facial nerve outcomes.

BIBLIOGRAPHY