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Modiolar Rotational Cheiloplasty: Addressing the Central Oval in Facial Paralysis

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**Objectives/Hypothesis:** Current static reanimation of the midface fails to provide adequate functional and aesthetic improvement; there is a need for more effective static correction of the ptotic midface. Our objective herein was to describe a novel method of static midface suspension that produces improved functional and aesthetic outcomes compared to previous techniques. Specifically, our goal was to describe the technique of alar and oral commissure repositioning via modiolar rotational cheiloplasty with alar base transposition, and gingivobuccal sulcoplasty.

**Study Design:** Retrospective case series.

**Methods:** We retrospectively reviewed the results of a series of adult patients desiring surgical intervention for paralysis of the central oval of the face at a tertiary care referral center. We present our technique of modiolar rotational cheiloplasty first with an example case, including subjective outcomes reported by the patient and objective improvements in facial appearance using Massachusetts Eye and Ear Infirmary Facial Assessment by Computer Evaluation Program (MEEI FACE-Gram) software, then demonstrate long-term outcomes from the series.

**Results:** Clinically, patients noted subjective improvement in drooling, buccal stasis of food, dysarthria, nasal obstruction, and overall appearance. Patients with significant atrophy and lateral displacement of the lower lip underwent concomitant wedge resection, which further improved the symmetry and position of the lips. The MEEI FACE-Gram software demonstrated objective improvement in symmetry of smile and position of the philtrum and nasal base in an example case.

**Conclusions:** Modiolar rotational cheiloplasty with alar base transposition is an effective and efficient static procedure for midface palsy that improves both function and appearance.

**Key Words:** Facial paralysis, static reanimation, original technique.

**Level of Evidence:** 4

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INTRODUCTION

The management of facial paralysis is continually developing and changing as new static and dynamic interventions are described and perfected. Commonly, the face is separated into upper facial (forehead and periorbital), midfacial (cheek), and lower facial (perioral) units, and each unit is approached and managed individually. Currently, there are many dynamic and static options to address the mid and lower facial units for patients with flaccid or spastic paralysis. Dynamic smile reanimation can be accomplished with nerve transfer, such as from the masseteric nerve, hypoglossal nerve, accessory nerve, phrenic nerve, or cross-face nerve graft. For patients who have experienced muscle atrophy, free nerve and muscle transfer, such as a gracilis muscle free flap with obturator nerve, is an option. Temporalis tendon transfer has also been described as a dynamic option for smile reanimation. Although dynamic options are often preferred, not all patients are good free tissue transfer candidates, and others elect, for various reasons, to undergo static procedures.

Static procedures addressing the upper third of the face can be very effective and lead to acceptable cosmetic outcomes. These include brow lift, upper eyelid weight placement, medial and lateral canthopexy, tarsal strip, and similar procedures. However, current static procedures addressing the midface are suboptimal. For example, alar batten graft placement may improve nasal passage obstruction, but it does not correct the position of the alar base or straighten the nose. Oral commissure suspension techniques using temporalis tendon, fascia lata, or synthetic materials pull the mouth in an abnormal vector leading to an unnatural facial appearance. Furthermore, simple suspension procedures allow recurrence of facial droop over time. Thus, there is a need for more effective static procedures for the paralyzed midface.

Symptoms commonly experienced by the patient with paralysis of the midface, or central oval of the face, include facial asymmetry (collapse of the ipsilateral nose with displacement of the tip toward the innervated side, rotation and drop in the ipsilateral oral commissure with...
atrophy of the orbicularis oris muscle, and pulling of the lips toward the contralateral side), difficulty with speech (particularly formation of plosives), pocketing of food in the ipsilateral inferior gingivobuccal sulcus, drooling, nasal obstruction, and displacement of the alar base with collapse of the external valve. In addition, there is often hypertonicity in the innervated side of the face due to compensatory contralateral contraction.6

Herein, we describe the technique of static alar and oral commissure repositioning via modiolar rotational cheiloplasty (MRC) with alar base transposition, including gingivobuccal sulcoplasty and wedge resection of the lip as needed. We demonstrate the technique in a case series. We propose that this technique of static nasolabial correction provides aesthetic improvement in oral commissure and alar base positioning that is superior to that achieved by sling procedures alone. Furthermore, the technique provides functional improvement, not only in relief of nasal passage obstruction comparable to alar base graft placement, but also in oral commissure competence leading to less drooling and pocketing of food, and easier production of plosives during speech. Lastly, repositioning of the paralyzed side of the face alleviates compensatory contraction of the contralateral (innervated) side.

MATERIALS AND METHODS

Operative Technique

Prior to surgery, a detailed surgical plan is created based on the patient’s symptoms and appearance. All patients are considered first for reinnervation or muscle transfer procedures, but when these procedures are declined or, for other reasons, are not options, the patient is offered MRC with alar repositioning. The majority of patients with denervation of the central face request repositioning of the oral commissure due to oral incompetence, drooling, and facial asymmetry. Laxity of skin on the affected side of the face combined with muscle atrophy and unopposed pull of the contralateral musculature leads to an S-shaped deformity of the commissure, inferior malposition of the alar base, and effacement of the melolabial sulcus (Fig. 1). Patients are queried on the degree of difficulty they have speaking, particularly with plosive formation. The lips are examined to determine the degree of muscular atrophy, as well as the amount of displacement due to unopposed retraction by the contralateral side. If the latter factors are significant, a partial wedge resection of the lower lip is planned. If there is significant disruption of the upper lip as well, an upper lip wedge resection may also be performed, but we undertake this at a later date to confirm its necessity once the modiolar malposition has been corrected.

The procedure is begun by marking the melolabial sulcus and alar–facial groove on the paralyzed side of the face (Fig. 2A,B). For comparison, the contralateral melolabial sulcus is also marked, and the distance from the sulcus to the oral commissure is measured and used to guide appropriate and symmetric marking of the sulcus on the paralyzed side. The desired amount of vertical rotation of the oral commissure is measured and marked on the skin. We typically aim to elevate the modiolus 5 to 10 mm higher than the contralateral side (depending on the patient’s age and degree of soft tissue laxity) to allow for mild relaxation of the position postoperatively. The incision is made with a no. 15 blade from the nasal vestibule, around the ala, and through the superficial facial musculature along the melolabial crease. Sensory nerve branches are preserved. A perioral musculocutaneous flap is elevated through blunt and electrocautery dissection, taking care not to violate the oral mucosa (Fig. 2C). The perioral flap is then rotated superiorly and medially (Fig. 2D). The modiolus is set into the planned position and sutured in place. Conservative excision of skin lateral to the incision may be performed in the fashion of a reverse face lift if desired. The superior-most aspect of the flap is transposed with the nasal ala and placed into the floor of the nasal vestibule in a technique similar to Z-plasty, thereby lateralizing the alar base to the desired degree (Fig. 3). The superior aspect of the flap is suspended in its new position. The nasal alar incision and vestibular incisions are closed in a single layer with nonabsorbing monofilament and fast gut, respectively. The melolabial incision is closed in three layers, the first and most important layer reattaching the perioral musculature to the superficial musculoaponeurotic system. Finally, the skin is closed with 5-0 or 6-0 interrupted sutures.

Modiolar rotational cheiloplasty and alar base Z-plasty can be combined with gingivobuccal sulcoplasty, wedge resection of the lower lip, or wedge resection of the upper lip as necessary to further improve oral competence. In the case of a gingivobuccal sulcoplasty, a wedge-shaped incision extending from the inferior gingivobuccal sulcus anteriorly to the oral commissure is marked and a mucosal excision completed (Fig. 4). This is designed to vertically shorten the gingivobuccal sulcus. The defect is then closed primarily, thus removing excess buccal mucosa and tightening the gingivobuccal sulcus. We performed a wedge resection for cases of significant atrophy and lateral displacement of the lower lip, when we felt oral commissure repositioning alone would not fully alleviate symptoms of food pocketing, difficulty chewing, and dysarthria. We also performed an upper lip wedge resection in some patients who had previously undergone lower lip wedge resection to further improve upper lip positioning, but we have not typically found this to be necessary.

Fig. 1. Typical midface droop in two patients with unilateral facial paralysis. Note the inferior malposition of the oral commissure and alar base on the affected side, with effacement of the nasolabial fold.
Postoperatively, patients are provided pain control, a stool softener, and antibacterial ointment to be applied to their skin incisions twice daily. Patients are asked to avoid opening the mouth widely for 10 days. Sutures are removed one week postoperatively, after which patients are followed periodically in the clinic.

**Case Series**

We have performed MRC in 10 patients. As an example case, patient G.B. presented with chronic right-sided facial palsy and complaints of drooling, dysarthria, nasal passage obstruction, and displeasure with the appearance of his face. Physical examination demonstrated right hemifacial paralysis with
inferior displacement of the alar base and inferior rotation of the oral commissure, causing oral incompetence. He was not interested in dynamic reanimation surgery, and instead elected to try MRC with alar base transposition. He did not suffer from excessive thinning of the lateral lip, so wedge resection was not recommended. Figure 5 shows his pre- and postoperative appearance in addition to the preoperative appearance of a different patient with results at 1 and 5 years postoperatively. Improvement can be seen postoperatively not only on the side affected by facial palsy, but also on the contralateral, normal side of the face due to relaxation of previous compensatory contraction (Fig. 5). In Figure 6, pre- and 5-year postoperative photos are shown in addition to artificial faces in which one side of the face has been reflected over the opposite side. The artificial reflection photos demonstrate two very different people in the preoperative series, whereas the reflection photos demonstrate similar people in the postoperative series, highlighting the improvement in long-term facial symmetry that MRC has produced.

RESULTS
We have performed MRC on 10 patients at the senior author’s (K.S.M.) institution over the last 7 years without significant complication. Eight patients were male and two female, with ages ranging from 48 to 52 years (mean age = 65 years). Other procedures we
have combined with MRC include blepharoplasty, placement of an upper eyelid weight, medial canthopexy, lateral canthopexy, wedge resection of the upper or lower lip, face lift, and brow lift (Table I). In total, seven patients underwent primary lower lip wedge resection, and two of these patients later desired upper lip wedge resection to further improve oral commissure positioning and speech, both of which were performed without complications. Patients in this series have been followed for a minimum of 1 year (range, 1–11 years; mean = 6 years).

Patient G.B. noted subjective improvement in nasal breathing and speech in addition to decreased drooling. Overall, he was very pleased with the functional and aesthetic improvement in his face at rest. Using the Massachusetts Eye and Ear Infirmary FACE-Gram software (software available for free download at http://sircharlesbell.org/facial_nerve_programs.html), we compared the ptotic side of the face to the normal side. First, we compared the angle (angle A) created by a line drawn from the lowest point of the lower lip to the most lateral aspect of the oral commissure and a vertical line through midline (A, Fig. 7). Preoperatively, the normal side demonstrated an angle A of 108°, whereas the ptotic side was 88°. Similarly, the normal alar base was 19 mm from the midline base of the nose, whereas the ptotic alar base was only 7 mm from the midline base of the nose. Philtral deviation measured 22 mm preoperatively. Postoperatively, the normal side of the face demonstrated an angle A of 101°, and the abnormal side demonstrated an angle A of 103°. The normal alar base was again 19 mm from midline, but the ptotic side was corrected to 15 mm from midline. Philtral deviation was reduced to 5 mm postoperatively. MEEI FACE-Gram measurements for the normal and ptotic hemiface, both pre- and postoperatively, are shown in Table II.

**DISCUSSION**

Various techniques of resuspending the alar base and oral commissure have been described to improve nasal passage obstruction and facial asymmetry at rest. One well-described technique includes fascia lata harvest and suspension of the nasal base and oral commissure to the zygomatic arch or temporalis...
Suture and other synthetic materials have also been used to suspend the mid and lower face. How-
however, all suspension techniques are susceptible to relaxation and the need for resuspension over time, similar to a
face lift, due in part to the long distance from the point of
fixation to the central oval of the face. In addition, fascia
lata harvest carries donor site morbidity, and use of
suture or other synthetic materials carries the risk of for-
gotten body reaction and inflammation. An alternative,
suspension to the temporalis fascia, tends to pull the oral
commissure in an abnormal vector, creating an unnatu-
ral resting position. Furthermore, it can cause excessive
bulk over the zygomatic arch, which is also cosmetically
displeasing. 5

Modiolar rotational cheiloplasty with alar base
transposition, with or without gingivobuccal sulcoplasty
or wedge resection of the upper or lower lip, is a simple,
efficient procedure that repositions the oral commissure
and opens the external nasal valve, as demonstrated in the
dissection. The procedure relocates rather than sus-
pends the perioral and alar tissues, which results in a
more natural appearance with improved longevity of the
result. The scar created in doing so recreates the melola-
bial fold with improved symmetry; it avoids donor site
morbidty associated with fascia lata and other autolo-
gous material harvest, and it carries no risk of foreign
body reaction. When combined with a gingivobuccal sulco-
plasty, it has the potential to reduce pocketing of food in the
gingivobuccal sulcus. Furthermore, by improving oral
competence, it also has the potential to diminish drooling
and improve plosive speech. When wedge resection of the
lip is performed, labial symmetry is improved, and func-
tional orbicularis oris muscle is recruited to the paralyzed
side. Next, by improving commissure closure, it may also
decrease the risk of dental decay due to exposure.

Although the mean age of patients in our cohort was
65 years, MRC can successfully be used in younger
patients as well. Our incisions are placed in the border
between aesthetic facial subunits, and as such, they heal
well and provide aesthetically favorable scars. The overall
postoperative improvement in function and facial aes-
thetics from MRC outweighs the minor scarring that may
be more apparent in a younger population. We have
observed changes in the normal, unoperated hemiface
after MRC, likely due to secondary effects of the proce-
dure including relief from compensatory contralateral
contraction. Patients often carry increased tension in the
normal sides of their faces in an attempt, perhaps uncon-
scious, to alleviate contralateral facial palsy. By improv-
ing the position of the ptotic face, MRC allows relaxation
of heightened tension in normal facial musculature, a
similar idea to Herring's law in ptosis correction.

Our technique carries with it the risk of webbing at
the alar–facial groove as a result of tissue repositioning.
We have found that there is loss of the superior aspect of
the alar–facial groove after MRC. In our experience,
however, and as demonstrated in Figures 5 and 6, this has not typically been a significant issue. The procedure is justified given the overall aesthetic and functional improvements provided, despite the minor webbing that may occur.

Modiolar rotational cheiloplasty,alar base transposition, and gingivobuccal sulcoplasty (with or without partial labial wedge resection) are indicated in patients with ptosis of the central oval of the face who are not candidates for or who do not desire reinnervation. These interventions can easily be combined with other procedures to address paralysis of the upper face. Our initial experience with these techniques has demonstrated improved aesthetic and functional results relative to other static procedures for midfacial paralysis.

There are weaknesses to our current study. First, it is a preliminary look at a new technique; a follow-up study with a larger cohort will help to delineate more fully the outcomes of the technique and in what subset of patients it can most effectively be applied. A follow-up study will also be able to compare patients who elect to undergo MRC to those who elect dynamic reanimation options. Next, our study carries some inherent bias, both because it is retrospective and because it is from the experience of a single surgeon. Finally, differences in gender can affect skin laxity; in our study, the degree of oral commissure lift was based purely on the degree of subunit ptosis and facial laxity. A follow-up cohort could better elucidate the amount of lift needed for males compared to that required for females.

CONCLUSION
Modiolar rotational cheiloplasty with alar base transposition and gingivobuccal sulcoplasty is an effective method for managing palsy of the midface among patients who cannot undergo or do not desire dynamic reanimation procedures. It is particularly suited to older individuals who do not mind a larger incision on their face and in whom a facial incision is easier to hide. It has the potential to provide improved aesthetics and functional outcomes in the central oval of the face, an area that has been highly challenging to correct. We have found in this initial pilot study that these procedures improve appearance, breathing, speech, and mastication; an outcome evaluation is underway.

BIBLIOGRAPHY