

## Hemihypoglossal–facial nerve anastomosis in treating unilateral facial palsy after acoustic neurinoma resection

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✓ Eight patients underwent hemihypoglossal–facial nerve anastomosis (anastomosis of a split hypoglossal nerve to the facial nerve) for treatment of unilateral facial palsy. All patients previously had undergone resection of a large acoustic neurinoma and the facial nerve had been resected at that time. The interval between tumor resection and hemihypoglossal–facial nerve anastomosis ranged from 1 to 6 months, with an average of 2.1 months. Postoperative recovery of facial movement was good in all cases during an average follow-up period of 4.2 years. In all eight patients, the degree of hypoglossal nerve atrophy on the operated side was graded mild or moderate, but not severe. It was concluded that hemihypoglossal–facial nerve anastomosis results in good facial reanimation as long as the procedure is performed early after the onset of facial palsy and that this procedure may reduce the degree of hemiglossal atrophy in comparison with classic hypoglossal–facial nerve anastomosis.

**KEY WORDS** • nerve anastomosis • hypoglossal nerve • facial palsy • acoustic neurinoma • hemiglossal atrophy

**H**YPOGLOSSAL–facial nerve anastomosis remains the most popular technique for treating facial palsy, although there is criticism with respect to the donor nerve deficit—hemiglossal atrophy. Some modifications, including anastomosis of a split hypoglossal nerve or a descending hypoglossal branch to the facial nerve, have been designed to reduce hemiglossal atrophy. Conley<sup>3</sup> and Conley and Baker,<sup>4</sup> in reviewing their experience with 137 cases of hypoglossal–facial nerve anastomosis over a period of 30 years, concluded that the use of a split nerve or a descending hypoglossal branch would not achieve the expected facial reanimation and improvement in facility of the tongue.

We report our experience with hemihypoglossal–facial nerve anastomosis in treating unilateral facial palsy after acoustic neurinoma resection in eight patients. The use of a split hypoglossal nerve is reevaluated.

### Clinical Material and Methods

#### *Patient Population*

Eight patients, five women and three men ranging in age from 34 to 67 years (average 56 years), underwent hemihypoglossal–facial nerve anastomosis for treatment of unilateral facial palsy (Table 1). All patients previously had undergone resection of a large acoustic neurinoma, at

which time the facial nerve was known to have been resected. Additionally, in four patients a sural cross-facial nerve graft was implanted with the idea of connecting this in a second-stage operation to the appropriate branch of the facial nerve receiving hypoglossal reinnervation. However, all four patients refused this secondary operation, and the sural nerve graft remained unattached to the facial nerve on the paralyzed side. The interval between tumor resection and hemihypoglossal–facial nerve anastomosis ranged from 1 to 6 months, with an average of 2.1 months. Postoperative follow-up periods ranged from 3.0 to 5.3 years, with an average of 4.2 years.

#### *Grading of Unilateral Facial Palsy*

Facial nerve function was evaluated pre- and postoperatively using the facial nerve grading system of House and Brackman.<sup>9</sup> The assessment was made of gross facial appearance at rest, with movement, and during motion of the forehead and around the eyes and mouth. Facial nerve function was graded from I to VI.

#### *Hemihypoglossal–Facial Nerve Anastomosis*

A parotid incision was used. The facial nerve was identified at some point between the stylomastoid foramen and the posterior margin of the parotid gland, dissected free, and sectioned as proximally as possible. The hypoglossal

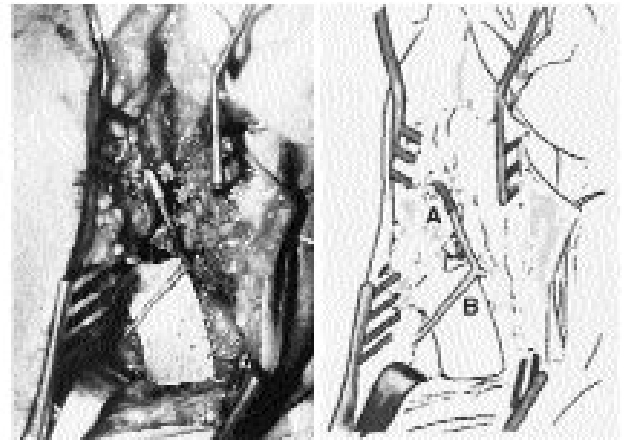
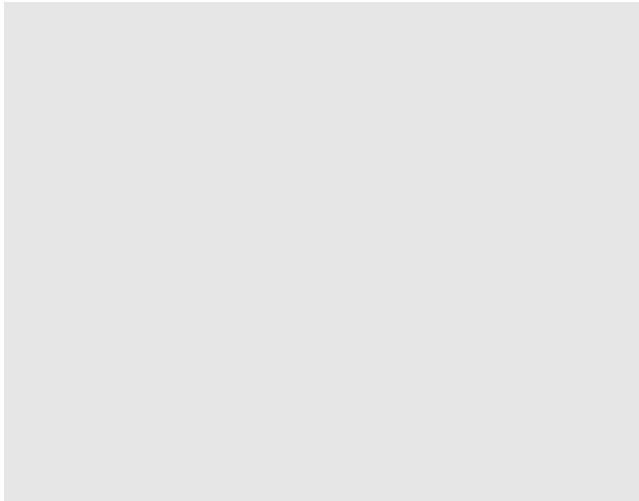


FIG. 1. Photograph (left) and drawing (right) illustrating hemihypoglossal-facial nerve anastomosis. A split hypoglossal nerve is anastomosed to a distal stump of the facial nerve (A), while the other half of the hypoglossal nerve (B) maintains its continuity.

nerve was exposed deeply to the plane of the digastric muscle and superficially to the carotid vessels. It was dissected free just before it passed deep to the mylohyoid muscle and was split in half, and this longitudinal dissection was continued to the level of the facial artery. One of the two halves of the hypoglossal nerve was divided as distally as possible, and its distal end then was anastomosed without tension to the distal stump of the facial nerve (Fig. 1) using three or four 10-0 nylon sutures. In the last two cases, each half of the split hypoglossal nerve was stimulated electrically and muscle contraction of the tongue was recorded by electrodes in the tongue. The half that showed the least response was selected for anastomosis to the facial nerve.

### Results

Facial nerve function in all eight patients was preoperatively graded V or VI. Postoperative recovery of facial movement was good (Grade III) in all eight cases (Fig. 2). The tone of the facial muscles generally showed signs of recovery within 4 to 6 months, with the restoration of facial symmetry at rest. Facial movement usually appeared first around the mouth and then progressed to the cheek and around the eye. There was a tendency for recovery of forehead movement to be delayed, and sometimes minimal; thus, additional surgery to lift the eyebrow was necessary in two cases.

Postoperatively, all patients required the continued use of topical medication to lubricate the eye until such time as the eye could close. Strong mass movement associated with eating or talking was observed in two cases, but neither patient complained about this excessive facial movement.

Hemiglossal atrophy ceased within 12 months after anastomosis in all eight cases, and further atrophy was not observed. The degree of atrophy was graded as minimal or moderate (Fig. 3 upper and center). No patient in this series suffered the severe hemiglossal atrophy we have observed in patients with other types of lesions (Fig. 3 lower). Only one patient, with moderate hemiglossal atrophy, complained of long-term postoperative inconvenience

in mastication and speech. There were no surgical complications in any patient.

### Discussion

Since the first report of hypoglossal-facial nerve anastomosis by Korte,<sup>11</sup> there have been many reports relating to the use of this technique for treatment of facial palsy secondary to surgery for acoustic neurinoma or other lesions.<sup>1,2,4,6-8,10,13-17,19</sup> The indications for hypoglossal-facial nerve anastomosis should be limited to those cases in which there is a failure in primary repair of the facial nerve during tumor resection and when patients have suffered complete and irreversible facial palsy. Some patients find the postanastomotic hemiglossal atrophy undesirable.

The hypoglossal-facial nerve anastomosis may be modified to reduce hemiglossal atrophy. Variations include anastomosis of a descending hypoglossal branch to the facial nerve,<sup>4</sup> anastomosis of a descending hypoglossal branch to the distal stump of the hypoglossal nerve after classic hypoglossal-facial nerve anastomosis,<sup>1,10,15</sup> hemihypoglossal-facial nerve anastomosis,<sup>4,5,10</sup> and a hypoglossal-facial nerve interpositional-jump graft<sup>13</sup> (interposing a nerve graft between a partially transected hypoglossal nerve and a transected facial nerve). Conley and Baker<sup>4</sup> reported their experience with 12 cases of hemihypoglossal-facial nerve anastomosis and three cases of anastomosis of a descending hypoglossal branch to a facial nerve. Conley<sup>3</sup> concluded that the use of a split hypoglossal nerve or a descending hypoglossal branch was not advisable because of disappointing results in expected facial reanimation and improvement in dexterity of the tongue. Kessler, *et al.*,<sup>10</sup> Chang and Shen,<sup>1</sup> and Pitty and Tator<sup>15</sup> anastomosed a descending hypoglossal branch to a distal stump of the hypoglossal nerve following classic hypoglossal-facial nerve anastomosis, but they failed to achieve improvement in tongue dexterity with this procedure. Dellon<sup>5</sup> and May, *et al.*,<sup>13</sup> reported excellent results in facial reanimation and facility of the tongue with

## Hemihypoglossal–facial nerve anastomosis



FIG. 2. Case 7. Photographs demonstrating almost complete facial paralysis 1 month after acoustic neuroma resection (*left*) and patient's ability to close his eye 1 year after hemihypoglossal–facial nerve anastomosis (*right*).

hemihypoglossal–facial nerve anastomosis and with a hypoglossal–facial nerve interpositional-jump graft, respectively.

Reinnervation of paralyzed facial muscles in our series of patients was quite satisfactory in comparison with the results of other studies of hypoglossal–facial nerve anastomosis,<sup>1,2,4,6–8,10,13–17,19</sup> although it is somewhat difficult to compare the results of various series for evaluation of postoperative recovery of facial nerve function because of significant variations in classification.

When a split hypoglossal nerve is employed in an anastomosis to a facial nerve, there is a question of whether or not a sufficient volume of axons is redirected to the mimetic muscle system to achieve the expected recovery of facial movement. The good results with our patients may indicate that a split hypoglossal nerve does offer sufficient axons to the mimetic muscle system as long as the anastomosis can be accomplished early after the onset of facial palsy. It should be mentioned that the time factor is very important in the recovery of facial movement when a cranial nerve anastomosis is considered for treatment of facial palsy. Facial muscle mass movements and dyskinesia occur with any type of cranial nerve anastomosis to the facial nerve and are induced by eating or speaking in patients with the hypoglossal–facial nerve anastomosis. Some type and quality of facial muscle mass movement has been reported to occur in 95% of patients with the classic hypoglossal–facial nerve anastomosis,<sup>4</sup> and this type of abnormal movement was observed in all eight of our patients, significantly so in two. These results indicate that using a split hypoglossal nerve does not reduce the occurrence of facial mass movement; however, none of our patients complained about the excessive facial movement.

Only slight recovery of the frontalis muscle was observed in two of our patients, requiring additional brow-lift surgery. A relatively low number of nerve fibers in the frontal branch of the facial nerve may partly explain the poor recovery of the frontalis muscle,<sup>18</sup> but this problem is common to any type of cranial nerve attachment to a facial

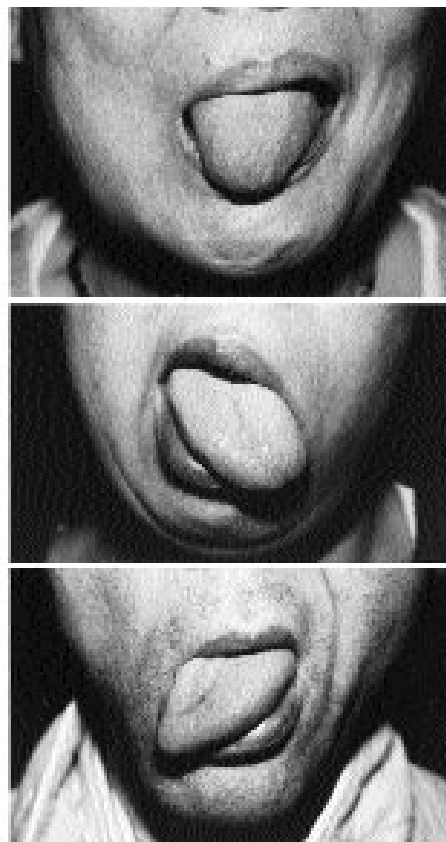


FIG. 3. Photographs demonstrating hemiglossal atrophy. *Upper:* The patient in photo shows minimal atrophy 4 years after hemihypoglossal–facial nerve anastomosis. *Center:* The patient has moderate atrophy 4.3 years postoperatively. *Lower:* Severe atrophy is shown in a patient with a jugular foramen neurinoma.

nerve and not to hypoglossal–facial nerve anastomosis in particular.

Because hemihypoglossal–facial nerve anastomosis provides only primary reinnervation of the facial musculature, as in the case of classic hypoglossal–facial nerve anastomosis, our patients were unable to regain the spontaneous movements of the face associated with emotions. Involuntary and emotionally based movement requires the transfer of nerve impulses from the contralateral intact facial nerve to the paralyzed side. As Dellon<sup>5</sup> indicated, the hemihypoglossal–facial nerve graft can be used as a means of preserving the facial musculature and myoneural junctions, so that cross-facial nerve grafting may be performed as a second-stage operation. In accordance with this concept, we performed sural cross-facial nerve grafting in four patients at the time of the hemihypoglossal–facial nerve anastomosis, and a second-stage operation involving anastomosis between the sural nerve graft and the facial nerve reinnervated by the split hypoglossal nerve was planned. Although the final outcome could not be evaluated because all four patients refused the second-stage operation, we believe that cross-facial nerve grafting following hemihypoglossal–facial nerve anastomosis is a very sophisticated procedure important to reanimation of a paralyzed face.

The severity of hemiglossal atrophy was of varying degree among our patients, but none of them suffered hemiglossal atrophy as severe or marked as that observed in some patients with classic hypoglossal-facial nerve anastomosis.<sup>2,4,7,10</sup> Furthermore, intraoperative electrical stimulation of the hypoglossal nerve was performed in the last two patients in this series, and only minimal hemiglossal atrophy was observed in these two patients. The use of a split hypoglossal nerve thus may reduce the severity of postanastomotic hemiglossal atrophy in comparison with classic hypoglossal-facial nerve anastomosis, although the number of our patients was limited and the results are not conclusive.

One of our patients has complained of prolonged difficulty in mastication and speech since the operation, although hemiglossal atrophy of this patient was moderate in degree. This morbidity must be due to hypoglossal nerve dysfunction, because this patient did not suffer multiple cranial nerve deficits secondary to the initial effects of the tumor or to complications from surgical removal of the tumor. Complaints regarding mastication and speech differ greatly among patients with even marked or severe hemiglossal atrophy, and some patients complain of difficulty whereas others do not.<sup>4,7,10</sup> Tolerance of speech difficulty also varies from patient to patient depending on their occupation. Currently, the indications for hemihypoglossal-facial nerve anastomosis should be restricted when speech is crucial to the patient's occupation, in the same manner as classic hypoglossal-facial nerve anastomosis.<sup>12</sup>

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TABLE 1

*Clinical summary of eight patients who underwent  
hemihypoglossal-facial nerve anastomosis*

Case No.	Age (yrs), Sex	Interval from Neurinoma Resection to Anastomosis (mos)	Follow-Up Period (yrs)	Recovery of Facial Nerve Function*	Tongue Atrophy
1	61, F	2.0	5.3	good (Grade III)	moderate
2	58, F	1.0	5.0	good (Grade III)	moderate
3	59, F	1.5	4.5	good (Grade III)	moderate
4	34, F	1.5	4.3	good (Grade III)	moderate
5	67, F	2.0	4.0	good (Grade III)	minimal
6	58, M	6.0	3.8	good (Grade III)	moderate
7	57, M	1.0	3.3	good (Grade III)	minimal
8	55, M	1.5	3.0	good (Grade III)	minimal

\* Postoperative facial nerve function evaluated using the grading system of House and Brackmann.<sup>9</sup>