REANIMATION of a recently injured facial nerve when the proximal stump is unavailable is generally performed using the seventh–12th cranial nerve jump graft, which utilizes only one half of the hypoglossal nerve joined to the extracranial facial nerve by a single cable graft. The importance of sparing part of the hypoglossal nerve was originally emphasized by Zehm and Hartenau in 1981, but in 1991 May, et al., definitively refined, popularized, and actually named the jump graft technique. This procedure uses only a portion of the hypoglossal nerve and has the enormous advantage of avoiding the tongue dysfunction that results from resection of the entire hypoglossal nerve. It is technically safe and the results are consistent and durable. Recovery starts approximately 7 to 8 months postoperatively, depending on the age of the patient, and the final functional result is generally good when the face is at rest but requires active, prolonged, and motivated training to mimic voluntary and involuntary movements. Closure of the eye generally requires separate treatment involving the insertion of either a gold weight or a fascial sling in the upper eyelid.

A limitation of the jump graft technique is the necessity of a graft together with its obvious double line of suture to be crossed by the regenerating axons as well as the resultant scarring and morbidity at the donor site (usually the sural nerve or, more rarely, the great auricular nerve). These factors have prompted us to develop an alternative method of facial nerve reanimation, although similar procedures have been previously reported by Darrouzet, et al., in 1999 and Atlas and Lowinger in 1997. Independent of us and on a different basis, the same technique was described by Donzelli, et al., in 2003 as a one-stage process for repeated treatment of three residual vestibular schwannomas via the translabyrinthine route.

End-to-side intrapetrous hypoglossal–facial anastomosis for reanimation of the face

Technical note

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The aim of this paper was to report on further experience with a new technique for reanimation of the facial nerve. This procedure allows a straight end-to-side hypoglossal–facial anastomosis without interruption of the 12th cranial nerve or the need for graft interposition. It is technically demanding and time-consuming but offers an effective, reliable, and extraordinarily quick means of reinnervating the facial muscles, including the orbicularis oculi muscle, thus avoiding the need for a gold weight in the eyelid or a fascial sling.

KEY WORDS • facial paralysis • vestibular schwannoma • facial nerve • hypoglossal–facial anastomosis • end-to-side nerve repair • translabyrinthine approach

Materials and Methods

Patient Population

Two young women (31 and 34 years old) underwent removal of a large (4-cm) vestibular schwannoma via the suboccipital retrosigmoid approach. Despite anatomical preservation of the nerve, complete facial paralysis (House-Brackmann Grade VI) ensued postoperatively (Fig. 1). At 1 year postresection, electromyography and clinical examination results showed evidence of irreversible damage and surgery was undertaken.

Surgical Technique

Via a transmastoid fossa approach, the intratemporal facial nerve is exposed from the vertical third portion up to the external genu. The nerve is traced medially into the facial recess and cut. The fallopian canal is then carefully opened using a diamond bur under continuous suction and irrigation, and the distal facial nerve is extracted and rerouted outside the stylomastoid foramen. Use of this procedure gains an additional length of 3.5 cm, compared with the length exposed during isolation of the nerve at the tragal pointer.

The hypoglossal nerve is prepared in the retromandibular space distal to the origin of the descending ansa, to enhance the possibility of recruiting powerful motor axons (Fig. 1). The main trunk of the nerve is progressively gently pulled using multiple No. 7-0 epineurial stay sutures and is anchored to the surrounding connective tissue in an upward and lateral position (Fig. 2 left) to join the facial nerve stump. Ensuring accuracy of this maneuver is of paramount importance to avoid tension at the level of the suture. At very high magnification, through a small epineurial window, the endoneuria of two descending fascicles are opened (Fig. 2 center) and connected end-to-side with the stump of...
the facial nerve. One or two No. 10-0 stitches and fibrin glue are applied (Fig. 2 right). No branch coming off the facial nerve is interrupted during this procedure.

Results

Accurate evaluation of the results is hindered by two important factors. First, regardless of the scale used, data somehow depend on the personal evaluation of the surgeon or the team. Second, and much more importantly, the House–Brackmann grading system can only be perfectly adapted for facial nerve recovery when a lesion in continuity is present (Bell or delayed postraumatic palsy) or a nerve-to-nerve repair is performed. Additional problems are encountered when the results are evaluated in light of a repair with a different nerve. In reporting the results of an extrafacial neurotization technique, one inevitably underestimates the quality of even the best results: the presence of obvious synkinesis, in fact, automatically classifies the upper limit as a House–Brackmann Grade III, regardless of the degree of motor activity present. Therefore, we currently use the system proposed by House and Brackmann and later adopted by the Facial Nerve Disorders Committee of the American Academy of Otolaryngology–Head and Neck Surgery (Table 1).

At 2 months postoperatively reinnervation starts and constantly improves during the 1st year. At only 3 months muscle tone is excellent at rest, and at 6 months facial muscle function is very good on controlled speaking or laughing. When the patient is emotionally upset (sudden burst of crying or laughing), the responses are uncoordinated and the sequelae of the palsy are clearly visible.

The ability to mimic such voluntary and involuntary movements is highly dependent on prolonged exercise at the mirror. Noticeable, however, is the fact that the orbicularis oculi muscle is also reinnervated. Very soon the lower part of the muscle is perfectly active and lagophthalmos is no longer visible. At approximately 7 to 8 months postoperatively the upper orbicularis oculi muscle is also functioning, and a good symmetric blinking reflex is present. The gold weight in the upper eyelid was removed without consequence. Follow-up evaluations were performed between 18 and 24 months posttreatment. The tongue was normal at this time.

Discussion

Based on our experience, this procedure is quick and reliable, and recovery has an overall better quality than that with the seventh–12th cranial nerve jump graft (26 cases in our previous series, unpublished data). The results are unquestionably dependent on the precision of the suture, and therefore microsurgical skill in nerve repair is obviously welcome. Of particular interest are the normalization of the sagging face as early as 2 months after nerve repair and the definitive resolution of the eye problem. Given the speedy

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**TABLE 1**

House–Brackmann scale for grading facial nerve function

<table>
<thead>
<tr>
<th>Degree of Function</th>
<th>Grade</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>normal mild dysfunction</td>
<td>I</td>
<td>normal &amp; symmetrical function in all areas</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>slight weakness noticeable only on close inspection; complete eye closure with minimal effort; slight asymmetry of smile with maximal effort; synkinesis barely noticeable; contracture or spasm absent</td>
</tr>
<tr>
<td>moderate dysfunction</td>
<td>III</td>
<td>obvious weakness, but not disfiguring; may not be able to lift eyebrow; complete eye closure &amp; strong but asymmetrical mouth movement with maximal effort; obvious, but not disfiguring, synkinesis, mass movement, or spasm</td>
</tr>
<tr>
<td>moderately severe dysfunction</td>
<td>IV</td>
<td>obvious disfiguring weakness; inability to lift eyebrow; incomplete eye closure &amp; asymmetry of mouth with maximal effort; severe synkinesis, mass movement, &amp; spasm</td>
</tr>
<tr>
<td>severe dysfunction</td>
<td>V</td>
<td>motion barely perceptible; incomplete eye closure, slight movement in corner of mouth; synkinesis, contracture, &amp; spasm usually absent</td>
</tr>
<tr>
<td>total paralysis</td>
<td>VI</td>
<td>no movement; loss of tone; no synkinesis, contracture, or spasm</td>
</tr>
</tbody>
</table>
TABLE 2

<table>
<thead>
<tr>
<th>Authors</th>
<th>No. of Patients</th>
<th>Donor Nerve</th>
<th>Tongue Function (no./total no.)</th>
<th>House–Brackmann Grade (no. of patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlas &amp; Lowinger, 1997</td>
<td>3</td>
<td>section of half CN XII</td>
<td>normal</td>
<td>III (3)</td>
</tr>
<tr>
<td>Darrouzet, et al., 1999</td>
<td>6</td>
<td>section of half CN XII</td>
<td>normal (4/6), min dysfunction (2/6)</td>
<td>III (5), IV (1)</td>
</tr>
<tr>
<td>Donzelli, et al., 2003</td>
<td>3</td>
<td>section of half CN XII</td>
<td>min dysfunction (3/3)</td>
<td>III (1), IV (2)</td>
</tr>
<tr>
<td>present study</td>
<td>2</td>
<td>endoneurial contact w/ CN XII fascicles</td>
<td>normal</td>
<td>II (2)</td>
</tr>
</tbody>
</table>

* CN = cranial nerve; min = minimal.

References