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Facial reanimation with the VII-XII anastomosis: Analysis of the functional and psychologic results

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The VII-XII anastomosis has been employed for more than a decade by The Otology Group, P.C., in the facial reanimation of patients undergoing extirpation of tumors involving the cerebellopontine angle and the skull base. A retrospective review based upon a detailed questionnaire and submitted photographic documentation from 61 patients forms the basis for this review. Details and analysis of the functional results include (1) onset of function, (2) synkinetic activity, (3) corneal irritation and associated ophthalmologic problems, (4) facial tone and symmetry, and (5) volitional mimetic function. From a psychosocial perspective, evaluation was made regarding (1) workplace and home acceptance, (2) self consciousness, (3) adaption, and (4) overall satisfaction. Because of the nature of its technical performance and reliability, the VII-XII anastomosis is an important technique for the otolaryngologist to be familiar with. Cognizance of the functional and psychologic results with this procedure will ensure optimal (yet realistic) rehabilitation for this patient population. (OTOLARYNGOL HEAD NECK SURG **94**:305, 1986.)

In an attempt to mollify the functional and psychologic disability associated with a peripheral facial paralysis, surgeons have employed a variety of operative modalities to reanimate the face.[1,3,4,8,13,17] Dynamic techniques employed include primary anastomosis, cable grafts, and crossed-nerve anastomosis. In addition, static procedures afford improvement alone or may be adapted (subsequent to a dynamic procedure) to enhance the functional or cosmetic result.

We have employed the facial hypoglossal anastomosis (VII-XII) for more than a decade in the management of patients who have sustained permanent damage to the facial nerve as a result of the extirpation of tumors at the skull base and cerebellopontine angle[11]. An analysis of the data obtained from a retrospective review of 61 cases, based upon information gleaned from patient questionnaires with photographic documentation, forms the basis of this report.

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Presented at the Annual Meeting of the American Academy of Otolaryngology—Head and Neck Surgery, Atlanta, Ga., Oct. 20-24, 1985.

Submitted for publication Oct. 23, 1985; accepted Dec. 5, 1985.

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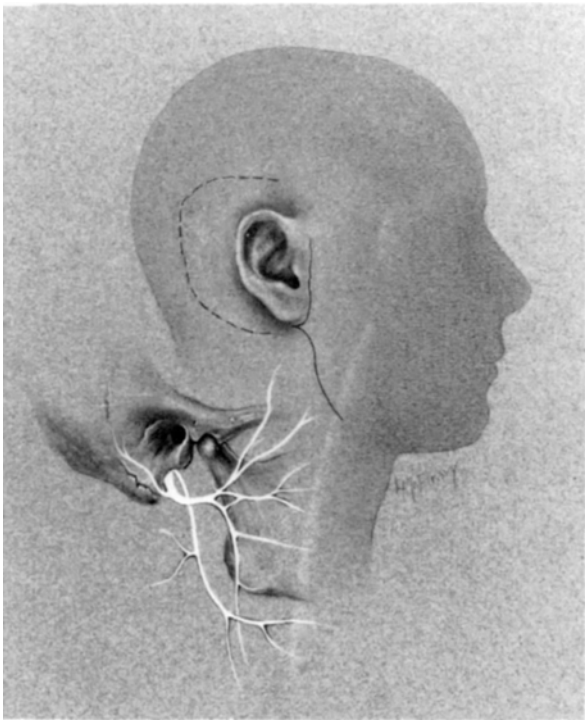

Fig. 1. Following acoustic neuroma surgery, a modified parotidectomy incision is made, care being taken to avoid the inferior margin of the extended postauricular incision.

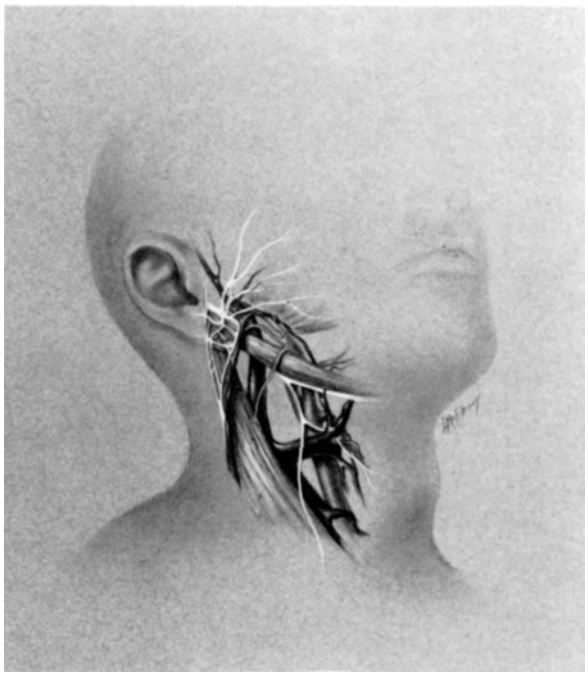

Fig. 2. Both the facial and hypoglossal nerves are clearly identified in the dissection.

TECHNIQUE

When employed following the removal of a skull-base tumor, the VII-XII anastomosis may be performed at the time of tumor removal. Following the removal of acoustic neuromas or other cerebellopontine angle tumors, the anastomosis is generally performed 5 to 7 days following the initial procedure.

Before the procedure, the patient is given a general anesthetic. A modified parotidectomy incision is made, care being taken to avoid the inferior margin of the previously created extended postauricular incision. The neck incision is extended along a skin crease below and parallel to the mandible (Fig. 1). The subcutaneous tissue and investing cervical fascia is opened, exposing the digastric muscle. Immediately deep to the diagastric muscle, the hypoglossal nerve is identified crossing laterally to the carotid artery bifurcation and the loop of the lingual artery (Fig. 2). As the nerve travels in a cephalic and forward direction, it is crossed by the facial vein, which is preserved. The ansa hypoglossi nerve, supplying the sternohyoid, sternothyroid, and omohyoid muscles, is divided as the nerve is mobilized distally just proximal to its submandibular course (Fig. 3).

The facial nerve is identified at the stylomastoid foramen by noting the "cartilagenous pointer," the position of the tympanomastoid suture line, and the fibers of the posterior belly of the digastric muscle. Once identified, the trunk is sharply divided and the nerve mobilized (in limited fashion) so as not to disturb the rich vascular supply of the parotid bed (Fig. 3).

Under microscopic visualization, the edges of the two mobilized nerves are freshened and juxtaposed *without* tension. The hypoglossal nerve may be positioned either lateral or medial to the posterior belly of the digastric muscle, depending on the length available. The salient advantage to its medial positioning is the stabilizing factor gained by this route.

A platform bridge of firm plastic or wood (tongue depressor) is placed in the surgical field to assist in the stabilization of the nerve endings. Generally, we employ four 9-0 nylon circumferential sutures to obtain a tension- and torque-free end-to-end epineural apposition (Fig. 4). Following this, hemostasis is obtained with a bipolar cautery and the operative field is irrigated with sterile saline solution. A layered closure is performed, and the skin is closed over a small drain. The latter is removed on the following day and a compression dressing is reapplied for 5 days.

Prior to discharge from the hospital, all patients undergo a lateral tarsorraphy.

POPULATION

This review is based upon data available from 61 patients. There were 38 women, with a mean age of 49.9 years, and 23 men, with a mean age of 47.6 years.

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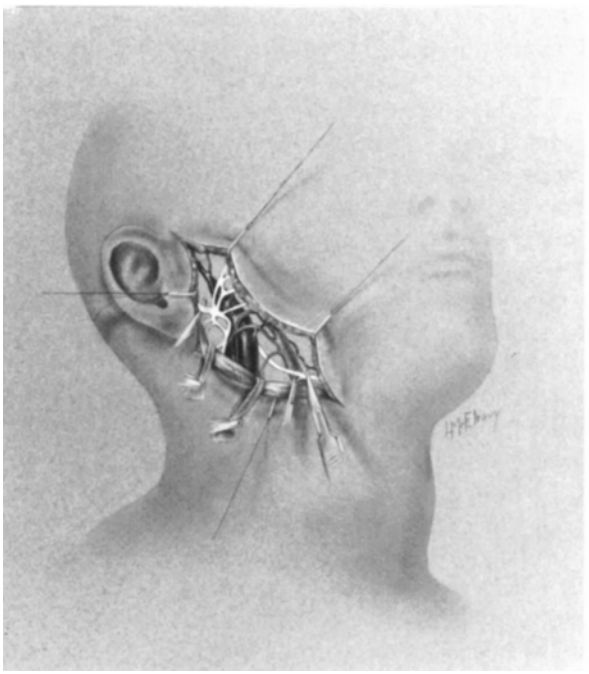

Fig. 3. The facial nerve is mobilized and sharply divided distal to the stylomastoid foramen. The ansa hypoglossi nerve is divided as the hypoglossal nerve is mobilized.

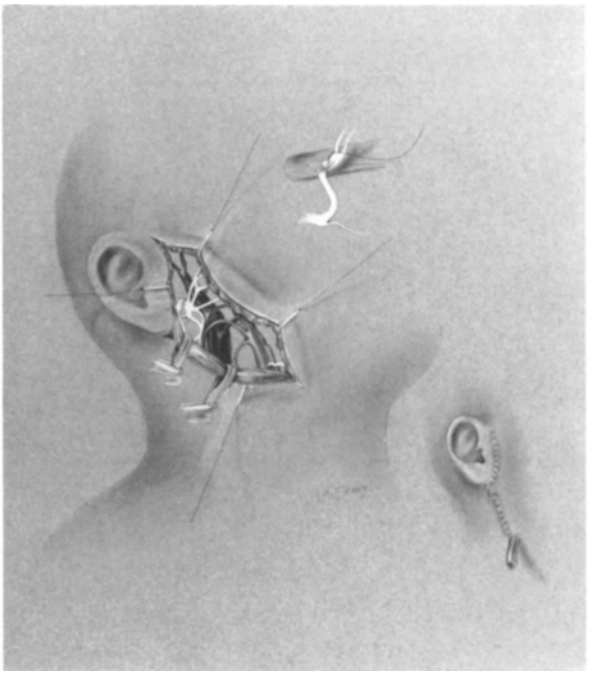

Fig. 4. Under microscopic visualization, the edges of the two mobilized nerves are freshened and juxtaposed *without* tension.

Fifty-eight patients had cerebellopontine angle tumors, 2 had glomus jugulare tumors, and 1 had a traumatic facial paralysis.

A recent review of data from The Otology Group, P.C., obtained from more than 500 patients with cerebellopontine angle tumors, reveals that in our series the facial nerve is preserved 98% of the time with small lesions (1.5 cm^2), 90% of the time with moderate-sized lesions (1.6 cm^2 to 2.9 cm^2), and 57% of the time in patients with large tumors (3.0 cm^2).

For patients undergoing VII-XII anastomosis, the follow-up period of observation ranged from 4 months to 11 years, with 79% of the group being followed for more than 2 years. Three patients included in the tabulated results responded within 6 months following surgery.

RESULTS

Patients were asked to evaluate and comment about three spheres of postoperative rehabilitative activity. These included (1) reanimation potential, as reflected by resting tone, mimetic function, onset, and favored areas of reanimation and synkinetic activity, (2) limitations encountered and problems associated with physical disability or complications, and (3) psychosocial disabilities.

Reanimation potential. Ninety percent of the patients regained facial movement to some degree. Forty-two percent noted the onset of activity between the first and sixth postoperative months, another 19% reported the onset of activity at between 6 months and 9 months, and 15% reported motion between 9 and 12 months. During the first half of the second postoperative year (12 to 18 months), 9% noted activity during the first quarter and 5% noted activity during the second quarter of the year, and 10% of the respondees have had no activity to date.* These data are summarized in Table 1.

The region of initial reanimation activity is shown in Table 2. The mouth area was the site of initial movement in 58% of the patients, while primary motion was noted around the eye by 18% of the respondees. Forehead activity was noted by 9% of the group, and only 7% cited the nasal area; however, it should be noted that an additional 4% described activity in the nasal-oral region and another 4% described nasal-orbital motion. Thus, nasal fold was reported by 15% of the population as the primary site of regional reanimation.

We defined a "good to excellent result" as one that achieved symmetry and "normal" facial tone (at rest) with a minimum of mass action or synkinesis upon motion. Furthermore, these results were to be complemented by minimal hypoglossal-oral dysfunction.

*Two of these patients responded within 6 months of surgery.

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Table 1. Onset of reanimation activity

Time (months)	Patient percentage
1-6	42
6-9	19
9-12	15
12-15	9
15-18	5
No movement	10%*

*Includes data from two patients with less than 6 months follow-up from the time of surgery.

Table 2. Region of initial reanimation activity

Location	Patient percentage	
Mouth	58	
Eye	18	
Forehead	9	
Nose	7	
Nose/mouth	4	15%
Nose/eye	4	

Three percent of the patients reported excellent results, and 39% believed that their results were good.

"Fair results" were defined as having limited mimetic function (with or without moderate functional synkinesis) and some degree of oral-hypoglossal dysfunction. These results were described by 48% of the patients.

Poor results were indicated by significant mass motion, distorting synkinesis, or no motion at all. These were reported by 10% of the respondees, including two patients who were less than 6 months past the time of anastomotic surgery.

Overall, some degree of synkinetic activity was reported by 67% of the responding patients. When specifically questioned regarding the extent of voluntary control over emotional facial expression, 27% of the patients said that they had complete volitional mimetic mastery. Seventy-three percent of the group thought that they had incomplete control of voluntary emotional mimetic response.

Physical disability. Clearly, there were two problematic areas identified by our patient population. The first concerned ophthalmologic disability. Despite the fact that 75% of the respondents reported that they did obtain eye closure, 21% of the patients made mention of ophthalmologic problems. Not all patients elaborated upon their disability as requested. Of those who did respond, dryness was a problem in 29% of the cases, 11% reported visual difficulty, 17% noted irritation, 9% reported pain, and 4% cited excessive tearing. Other problems reported included corneal abrasion and neurotrophic keratitis, and several patients expressed discomfort with (or limitation because of) the presence of a lateral tarsorraphy that was still in place.

With regard to oral motion tasks, 74% of the patients reported some degree of difficulty with eating, including mobilization of food on the paralyzed side. Moderate tongue atrophy was reported by 53% of the patients; however, only 21% considered this debilitating. Few patients specifically noted swallowing difficulty.

Gustatory tearing was noted to be present in 14% of the respondees and, although cosmetically unsettling, was not considered physically limiting.

Psychosocial disability. When directly asked about the effect of their facial appearance upon their social and business lives, 23% of the respondents noted that paralysis had resulted in a change in their social lives, while 21% noted an effect on their business lives.

Those persons who commented in detail regarding the effects of a partially reanimated face (or one with persistent paralysis) reflected a wide range of social, organizational, and personal situations. While no specific conclusions may be drawn, because of the complex patterns of behavior involved, certain adaptive mechanisms were evident.

Those who dealt with their debilities most readily expressed an appreciation for the close patient-physician relationship they experienced. Furthermore, many of these patients noted a high degree of empathy from co-workers and family. Moreover, persons with tenure, senior positions, or business commitments that could be, if necessary, redirected, adapted well.

Conversely, patients with unrealistic expectations, inflexible work situations, and social environments and situations that lacked specification and rootedness did not fare well. In addition, those who expressed dissatisfaction often reflected anger, depression, prolonged grieving, and a sense of fatalism regarding the postsurgical situation.

Because our patients experienced concomitant debilities (loss of hearing), it appears that a prerequisite to a stable rehabilitation period is the ability of the patient to modify his behavior without feeling threatened—either internally or from the social milieu.

Perhaps the summary statement by one of the patients best reflects an ever-present need: "I would recommend that part of your postoperative care include psychological counseling directed at reinstilling self-esteem/self-confidence in the patient. The psychological aspects of accepting yourself, as well as accepting external opinions (projected), provided a major portion of the recuperative effort."

Finally, when directly asked about overall satisfaction with the operative results, 74% responded posi-

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tively. Those who were most incapacitated by the psychosocial disabilities they encountered expressed much less satisfaction than did those with physical disabilities resultant from synkinesis, intraoral, or ophthalmologic problems.

DISCUSSION

From an historical perspective, the VII-XII anastomosis has been viewed by many surgeons in a favorable light.[2,4-7,10,15,16,18] Our review confirms that, for the majority of patients with intact mimetic musculature and a viable distal facial nerve, the facial-hypoglossal anastomosis offers a technically direct and dependable means of facial reanimation.

While Stennert[18] has commented upon the available data that suggest a preformed synergism between the facial nerve and the hypoglossal nerve, this remains hypothetical. Recently, though, Harrison described the recurrence of hemifacial spasm following a facial hypoglossal anastomosis.[14] It is generally believed that the degree of success with this technique results from the natural interplay between the two nerves as the patient is engaged in speech, mastication, and expression.

The optimal goals of any procedure that attempts facial reanimation include (1) maintenance of symmetrical tone at rest, (2) coordinated, natural, voluntary motion (with little or no synkinetic activity), and (3) lack of morbidity resulting from the procedure.

Conley and Baker[5] have highlighted the following factors as favorable in a consideration of the VII-XII anastomosis.[5] These include (1) technique of a direct suture line, (2) greater functional results because of the conscious/unconscious interaction between the two nerves, (3) no discomfort associated with loss of the twelfth nerve, (4) little functional loss from the absence of the twelfth nerve, (5) perioral motion that is natural during speech, and (6) dynamic functional merits.

Disadvantages as noted by Stennert[18] include (1) hemiparesis of the tongue, (2) lack of emotional mimetic responsive results, and (3) innervation of the muscles of the face only as a result of accentuated movements of the tongue, which may result in a grimace. Furthermore, Gavron and Clemis[10] have commented on chewing and postprandial problems encountered with oral hygiene because of limited oral-buccal function and tongue paralysis.

Whether the aforementioned variables result in part from the timing of the anastomosis is unclear. In general, it is not thought that the time of repair had a direct effect on the results[4,5]; however, Gavron and Clemis note that the combined effect of advanced age and a delay in repair (more than 1 year) led to an increase in adverse results in their series.[10] We are unable to comment upon this, since all of our patients were operated upon either immediately after or shortly following the facial paralysis.

Finally, while we cannot report the high degree of success and acceptance noted by Hitselberger,[15] we do believe that the procedure, when performed with meticulous microsurgical technique on a patient who understands the limitations of the procedure, will enhance the chances for restitution of facial activity, resulting in both patient and physician satisfaction.

CONCLUSION

The VII-XII anastomosis is a dynamic surgical procedure that may be selectively employed for the restitution of mimetic function in those patients with facial paralysis who are not candidates for primary anastomosis or interposition nerve grafts. Because of its uncomplicated technique and low morbidity, we have successfully employed this form of neurorrhaphy for more than a decade. Careful patient selection, realistic expectations, and meticulous operative technique will ensure optimal patient and physician satisfaction. Herein we have described our results with 61 patients undergoing this procedure.

We thank Robert W. Keith, Ph.D., for his assistance and service of this manuscript.

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The beneficial effect of triamcinolone acetonide on nerve repair with autogenous grafts

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Bilateral nerve cable graft repairs were made in the sciatic nerves of Wistar rats. One group of repairs was treated locally with triamcinolone acetonide (0.5 mg), one group was exposed to the systemic effects of the drug, and one group was left untreated. Nerve regeneration was measured by nerve-stimulated muscle twitch strength, as well as several electrophysiologic parameters of the compound action potential conducted through the graft. Results suggest that nerve regeneration through an autogenous graft is significantly improved by local treatment with triamcinolone acetonide. Further studies are indicated to determine appropriate dosage necessary to maximize the beneficial local effects. (OTOLARYNGOL HEAD NECK SURG **94**:310, 1986.)

Sacrifice of a significant amount of the facial nerve is often necessary during ablative surgery for removal of malignant lesions of the parotid gland or the temporal bone. Repair of this nerve defect, by means of an autologous nerve graft, has become an accepted practice.[1,2] This technique offers the advantage of reducing tension at the site of the repair while bridging the defect and providing a conduit through which neurons of the facial nucleus are directed toward the facial mimetic muscles.

One of the main obstacles to the optimal regeneration of transected nerves following repair is scar formation.[1,2] The inflammatory response incited in the area of repair causes the deposition of collagen by local fibroblasts. This impedes and disorders the growth of axons across the repair site and may cause the formation of a painful neuroma.[3-5] In the past, attempts to reduce the inflammation and improve nerve regeneration have centered on the use of proper microsurgical techniques, as well as delaying the repair in wounds that are contaminated.[1,2]

More recently, investigators have attempted to minimize scar formation pharmacologically at the site of nerve repair. Pleasure and co-workers used a proline analog (cis-hydroxyproline) systemically to inhibit collagen formation and reduce the scarring at the cut ends of transected nerves following primary repair.[4,6] Graham et al. have shown that triamcinolone acetonide, a synthetic corticosteroid, when instilled locally about the site of primary neurorraphy is beneficial to the regeneration and future function of that nerve.[7,8]

Regeneration of a nerve through an autologous graft necessitates growth of axons across two anastomotic sites, the most distal of which may not be crossed for days to weeks after the repair.[1,9,10] This delay leaves the distal site of coaptation more susceptible to the detrimental effects of scar formation.

We tested the theory that triamcinolone acetonide, instilled locally about the site of nerve graft repair, is

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Presented at the Annual Meeting of the American Academy of Otolaryngology—Head and Neck Surgery (Research Forum), Las Vegas, Nev., Sept. 16-20, 1984.

Submitted for publication Oct. 5, 1984; accepted Jan. 13, 1986.

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