Early Facial Reanimation Following Radical Parotid and Temporal Bone Tumor Resections

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A retrospective study of 35 patients who underwent early facial reanimation following extirpative parotid and temporal bone surgery requiring facial nerve sacrifice was performed. Regional facial reanimation performed immediately or within several days included 16 patients who underwent temporalis muscle transposition and 27 who underwent gold weight or eyespring lid reanimation with lower lid tightening. Simultaneous nerve grafts or nerve crossover procedures were performed in 22 patients. The authors' favored approaches to facial reanimation are discussed, with an emphasis on the value of early reanimation using properly selected techniques.

Facial paralysis associated with or caused by surgery for tumors of the head and neck and skull base causes significant cosmetic blight and functional disturbance. In every case, it is possible to restore some degree of facial function by choosing appropriate techniques. Moreover, the functional, cosmetic, and psychologic handicaps can be minimized if attention to facial rehabilitation occurs early in the course of treatment. However, selection of the appropriate method of facial reanimation is dependent on a number of factors that must be comprehensively analyzed and understood.

The purpose of this report is to review our experience with early facial reanimation following radial parotid and temporal bone surgery requiring facial nerve sacrifice.

PATIENTS AND METHODS

Drawing from over 400 facial reanimation procedures performed over the last 16 years (predominantly by the senior author, MM), a retrospective study of 35 patients who underwent facial reanimation following extirpative surgery for tumors of the parotid and ear was undertaken. The patients ranged in age from 30 to 82 years, with a mean of 56 years. Twenty-one patients with malignancy of the parotid, 6 with recurrent parotid pleomorphic adenomas, 1 with chronic sialadenitis, and 3 with malignancy of the ear and temporal bone underwent surgical resections resulting in sacrifice of the facial nerve. Four patients sustained a segmental (peripheral branch) injury during surgery for parotid neoplasms.

Regional facial reanimation performed immediately or within several days included 16 patients who underwent temporalis muscle transposition and 27 patients who underwent gold weight or eyespring lid reanimation with concomitant lower lid tightening or cartilage implantation. Nerve grafts or nerve crossover procedures were performed in 22 patients (18 for truncal injuries and 4 for segmental injuries).

RESULTS

Eye reanimation by either the gold weight implant or palpebral spring was judged to be successful in 25 of the 27 patients. Success was defined as significant improvement in eyelid closure, both subjectively and objectively, with adequate corneal protection. Although tarsorrhaphy was not performed in any patient, two patients did not achieve optimal eye closure. No patient required the use of a moisture chamber or eye shield after the surgery. Results were virtually immediate in all patients. There were no infections or implant extrusions in any of these patients. However, three patients required revision of the eyespring at varying intervals postoperatively.

Of the 16 patients whose lower faces were reanimated with a temporalis muscle transposition, 14 achieved satisfactory results (defined as some visible controlled voluntary mouth movement, absence of spontaneous mimetic movement, and good facial symmetry in repose). One patient had an unsatisfactory result, and one was lost to follow-up. Six patients required subsequent plication procedures to tighten the upward pull of the temporalis muscle and position of the oral commissure. Most of these patients underwent eye reanimation as well and were therefore able to achieve eyelid closure separate from mouth movement.

Of the 18 patients who underwent truncal nerve grafts or substitutions, all had facial function intact prior to their tumor surgery. Two patients underwent a hypoglossal-facial anastomosis, and one of these two had an adjunctive segmental crossfacial graft. Grafting was performed immediately in 15 patients and was delayed in 3. Superb results (defined as well-controlled, visible, separate individual facial muscle movement with some evidence of spontaneous mimetic function and good symmetry at rest) were achieved in five patients, excellent results (same as above without spontaneous mimetic motion) occurred in four, and good results (defined as some movement with effort and good symmetry in repose) in six. Tumor recurrence or lack of compliant follow-up pre-

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Figure 1. Left, patient with complete left facial paralysis following radical parotid surgery requiring facial nerve sacrifice. **Right,** patient 14 months following sural nerve graft. Note improved tone and symmetry.

cluded reporting results in the remaining patients. Seven patients underwent concomitant or subsequent temporalis muscle transposition as an adjunct to improve the quality or immediacy of the results.

All four patients who underwent segmental nerve grafts achieved excellent to superb results. All grafts were done immediately or within 3 days of the primary surgery. As expected, the more peripheral the injury, the less synkinesis was present.

COMMENTS

It is axiomatic that some method of facial reanimation is appropriate for most patients undergoing radical parotid or temporal bone surgery requiring facial nerve sacrifice [*1-4*]. However, the method(s) selected depend on a number of key issues, including site and cause of facial nerve injury or sacrifice, extent and severity of existing or induced functional and cosmetic deficits, timing from injury to intervention, and general host status and patient needs as they relate to overall prognosis and plans for future treatment [*5*]. The approaches considered most useful may be grouped as follows: (1) direct nerve repair or graft; (2) nerve crossover or substitution; (3) regional reanimation—eye reanimation, mouth reanimation; and (4) static support procedures.

Facial nerve repair or grafting is most appropriate following extirpative parotid or temporal bone surgery when certain conditions have been met. Facial function should be intact preoperatively. If a preoperative facial paralysis exists, the likelihood for satisfactory return of function following grafting is poor [*5*]. This is believed secondary to the progressive degree of distal neuronal fibrosis associated with the gradual process of neoplastic neuronal involvement. The most important consideration regarding a decision to repair or graft is timing. The best opportunity to restore mimetic facial expression and function after nerve transection occurs immediately after the injury; ideally, the nerve should be repaired at the time of transection, and if not possible at that time, then within 30 days of the injury. The results of proximal-to-distal nerve repair in patients with total facial paralysis after facial nerve interruption were disappointing when the nerve was grafted 1 year or longer after injury [*5,6*]. Clearly, the proximal and distal ends of the facial nerve must be available and suitable for grafting, that is, both the proximal and distal ends must be freshly prepared and contain viable axons. The important technical considerations of avoidance of anastomotic tension, proper neural alignment, selection of appropriate graft (i.e., greater auricular or sural nerve), and minimization of the risk of infection and devitalization of the tissue bed have been outlined elsewhere [*2,5,6*]. Planned postoperatively,

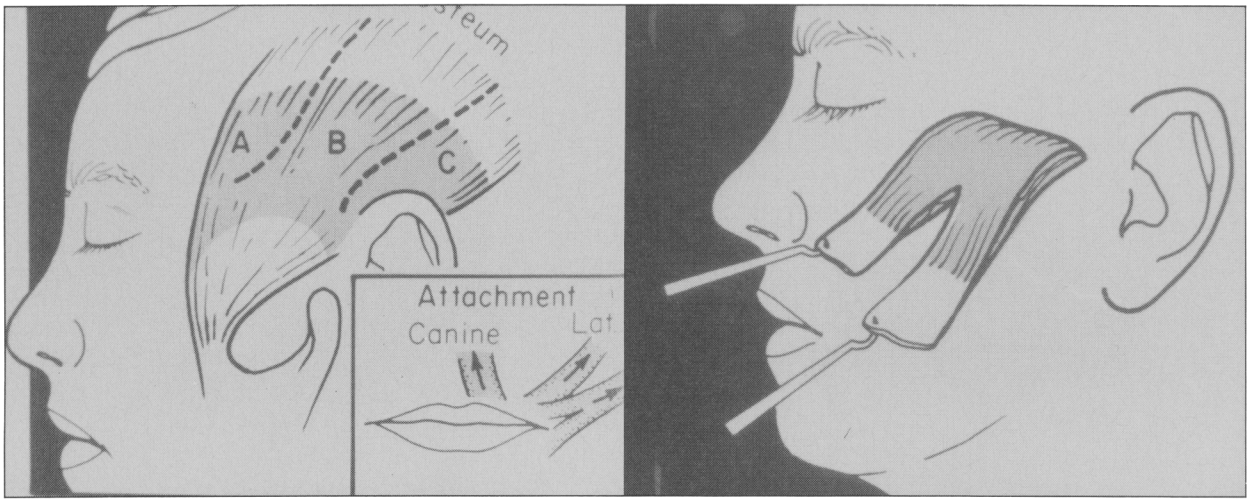

Figure 2. Left, outline of the central portion of the temporalis muscle in preparation for transposition. **Right,** transposition of this portion of the temporalis muscle is used for reanimation of the mouth. The entire muscle is not used. Separate eye reanimation is performed. (Reprinted from *[5]*, with permission.)

radiotherapy does not contraindicate the use of nerve grafts, although controversy exists regarding its effect on graft success *[7,8]*. Another consideration in deciding the appropriateness of nerve grafting relates to prognosis. The procedure is best suited for patients with a reasonable prognosis for long-term survival as the time for recovery is at least 12 to 18 months *[9]*.

When these considerations have been met, results of nerve repair and grafting have been very satisfactory in our experience. Of the 18 patients reported herein undergoing truncal nerve grafts (or 12-7 anastomosis) immediately or shortly after nerve transection, 5 demonstrated superb results (Figure 1), 4 demonstrated excellent results, and 6 demonstrated good results. Of the four patients who underwent immediate repair of a segmental branch injury, excellent results were obtained in all. Evidence of faulty regeneration, i.e., synkinesis, was less the more peripheral the injury.

Hypoglossal-facial nerve crossover is most appropriately indicated for complete and permanent facial paralysis when the central stump of the facial nerve is unavailable for repair or grafting and when performed up to 2 years, but not more than 4 years, after the injury *[5]*. This situation is most commonly seen following cerebellopontine angle tumor surgery, but may occur following radical temporal bone—parotid skull base surgery. The requirements for success are: (1) an intact extracranial facial nerve; (2) intact mimetic facial muscles; (3) an intact donor XII nerve; and (4) a patient who can physiologically and psychologically accept the neurologic deficit created by sacrifice of the XII nerve. As with primary repair and grafting, if the patient's outlook for survival is poor, the time required for success may not justify this approach. Moreover, patients at risk for other cranial nerve deficits (i.e., IX and X nerves) are considered poor candidates as the functional speech and deglutitory deficits may be profound.

Temporalis muscle transposition is our favored method of lower facial reanimation. This technique has proved to be successful in restoring some degree of facial function in patients whose facial paralysis cannot be treated by the restoration of the neuromuscular system *[4,5,9]*. Specifically, in patients with head and neck tumors, regional muscle transposition is especially useful when (1) paralysis is longstanding; (2) paralysis results from massive skull base resection in which the proximal stump of the facial nerve is unavailable or unsuitable for grafting, and the patient refuses or is unsuitable for a nerve substitution procedure; (3) paralysis occurs following radical parotid or temporal bone surgery for malignancy in which there is a poor prognosis for long-term survival; and (4) paralysis follows surgery that spared the facial nerve and spontaneous recovery is anticipated but has not yet occurred a year after surgery. In addition, temporalis transposition may be useful as an adjunct to the primary reanimation procedure as it does not interfere with functional neuromuscular recovery.

Using the technique of temporalis muscle transposition previously described elsewhere by the senior author (MM) *[5,6,9]*, in which the temporalis muscle is used to reanimate the lower face only (Figure 2), results are fairly predictable. Of the 16 patients described herein, 14 demonstrated good to excellent results (Figure 3). In a previous publication, May *[5]* reported good to excellent results using this technique in 38 of 40 (95%) patients with facial paralysis from a variety of causes. Unlike other reanimation techniques, temporalis muscle transposition can provide immediate results and allows eyelid closure to be separate from mouth movement. Temporalis muscle transposition, particularly when combined with eyelid reanimation techniques, can restore facial symmetry and provides a voluntary smile within 3 to 6 weeks.

We think it is best to perform the temporalis muscle transposition at the time of extirpative surgery, as it can be accurately positioned and eliminates the need for a second major surgical procedure within the area of tumor

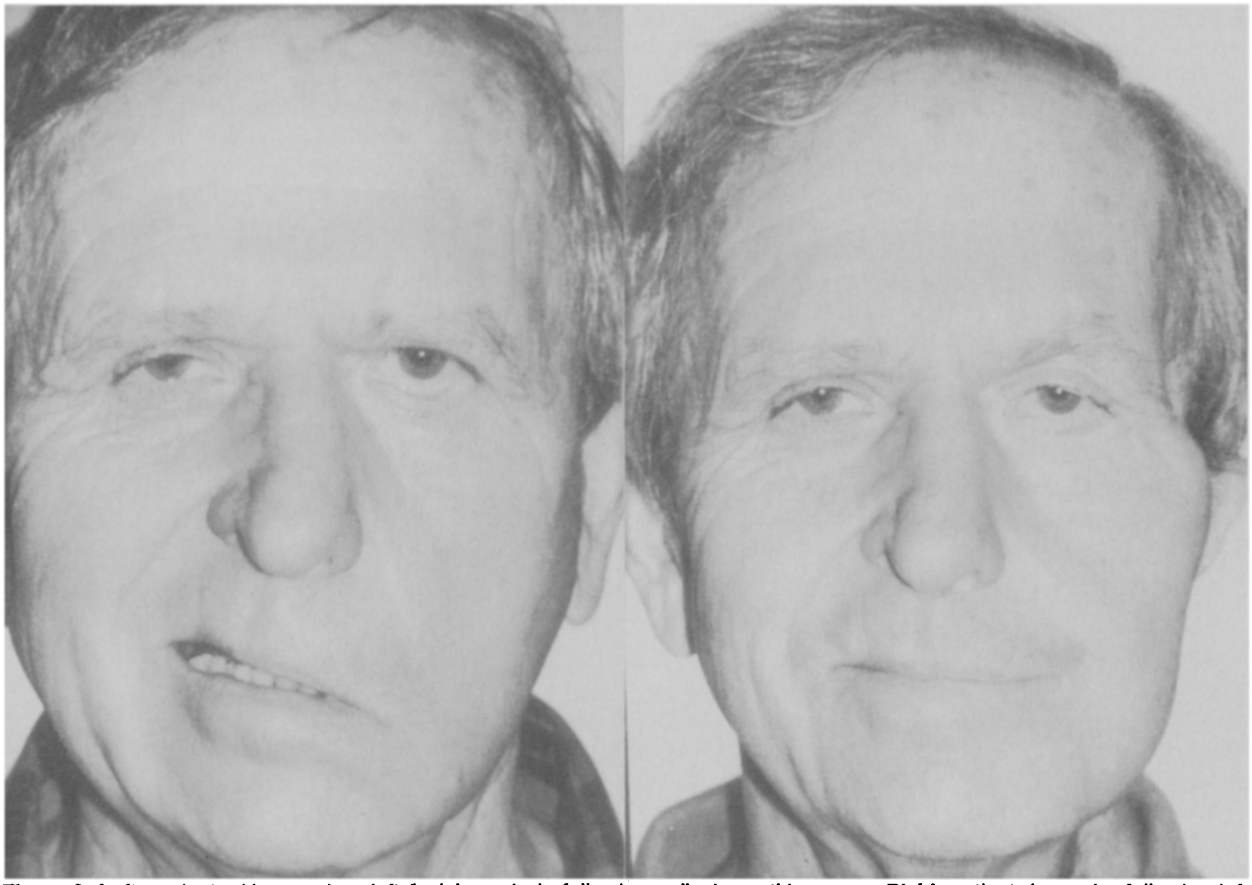

Figure 3. Left, patient with complete left facial paralysis following radical parotid surgery. **Right,** patient 4 months following left temporalis muscle transposition and eyespring implantation.

Figure 4. Left, patient with left facial paralysis and paralytic lagophthalmus. **Right,** patient with improved spontaneous eye closure after eyespring implantation.

resection and reconstruction. Caution should be exercised in more extensive resections that may have compromised the blood supply to the temporalis muscle.

From a functional standpoint, early reanimation of the paralyzed eyelid following cancer surgery is of paramount importance [*10*]. Within several days of facial nerve sacrifice, the effects of eyelid paralysis become significant. Lagophthalmus, ectropion, ineffective blink, ineffective tear distribution, epiphora, exposure keratitis, blurred vision, and corneal ulceration and scarring are the sequelae of an untreated paralyzed eye. In severe cases, corneal perforation and blindness can result. Tarsorrhaphy has been the classic method of providing protection. However, previous publications and our own experi-

ence have delineated the limitations of this approach and provided more acceptable alternatives [*10,11*].

Our favored techniques for reanimating the paralyzed upper lid are gold weight and eyespring implantation. Eyelid closure is accomplished with the gold weight by the forces of gravity. As such, it works best when the patient is upright, although eyelid closure is also improved when the patient is supine, provided he or she sleeps with the head elevated on a pillow. The eyespring functions on the basis of its intrinsic mechanical design, unrelated to the effects of gravity. The spring tends to remain open unless counteracted by the levator superioris which closes the spring when the eyelid elevates. Although technically more demanding, it allows for a faster blink and is preferred for patients with powerful lid retraction or a poor Bell's phenomenon [*10,11*].

Upper eyelid reanimation by either a gold weight or spring does not relieve the lack of tone or ectropion of the lower lid. Thus, lower lid tightening and cartilage implantation to the lower lid are often performed simultaneously to restore maximal eyelid function [*5,10,11*].

Experience with these eye reanimation approaches has been reported by May [*10*] and Sobol and Alward [*11*]. Excellent results defined as satisfactory eyelid closure, adequate corneal protection, and patient satisfaction occur in over 90% of patients (Figure 4). Vision is unrestricted, and the procedure is reversible if eyelid function returns by reinnervation. The importance of early intervention following major parotid and temporal bone surgery is emphasized by the successful results in most of the patients reported here. Most achieved satisfactory eyelid closure and protection. Our experience suggests that these procedures be performed within several days of paralysis to select the most suitable combination of eye reanimation procedures. Proper eye care in the immediate postoperative period is stressed.

Using a combination of properly selected regional reanimation approaches following radical parotid, temporal bone, and skull base surgery can lead to improved restoration of eye and mouth function in most patients. Early reanimation reduces the functional and psychologic problems associated with longstanding paralysis, does not interfere with planned postoperative radiotherapy, may restore function not duplicated by grafting or transposing nerves, and improves the quality of life of patients in whom tumor surgery was palliative. While nerve grafting and crossover techniques are valuable long-term rehabilitative approaches in appropriately selected patients, they fail to provide any short-term benefit. Regional techniques can satisfactorily reanimate the eye and mouth rapidly and predictably without compromising potential return of function from nerve grafts or substitutions.

REFERENCES

1. Bridger GP. Surgery and facial nerve grafting and malignant parotid disease. Aust N Z J Surg 1970; 39: 232–8.
2. Conley JJ. Facial rehabilitation following radical parotid gland surgery. Arch Otolaryngol 1957; 66: 58–66.
3. Laage Hellman JE. Facial nerve in parotidectomies. Arch Otolaryngol 1965; 81: 527–33.
4. Baker D, Conley J. Regional muscle transposition for rehabilitation of the paralyzed face. Clin Plast Surg 1979; 6: 317–31.
5. May M. Surgical rehabilitation of facial palsy. In: May M, ed. The facial nerve. New York: Thieme, 1986: 695–780.
6. May M. Facial reanimation and skull base trauma. Am J Otol 1985; [suppl] 62–7.
7. Gullane PJ, Havas TJ. Facial nerve grafts: effects of postoperative radiation therapy. J Otolaryngol 1987; 16: 112–5.
8. McGuirt WF, Welling DB, McCabe BF. Facial nerve function following irradiated cable grafts. Laryngoscope 1989; 99: 27–34.
9. May M. Muscle transposition for facial reanimation, indications and results. Arch Otolaryngol 1984; 110: 184–9.
10. May M. Reanimation of the paralyzed eyelid following cancer surgery. J Head Neck Cancer 1985; 1: 481–91.
11. Sobol S, Alward P. Early gold weight implantation for reanimation of the paralyzed eye. Head and Neck 1990; 149–53.