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Masseteric nerve transfer for short-term facial paralysis following skull base surgery☆

Nobutaka Yoshioka*, Shinsuke Tominaga

Department of Craniofacial Surgery and Plastic Surgery, Tominaga Hospital, Osaka, Japan

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Summary *Background:* Nerve transfers have been widely used to reanimate paralyzed facial muscles after irreversible proximal injuries to the facial nerve. The author has developed a technique involving masseteric nerve transfer combined with cross-facial nerve grafting for treating skull base surgery-induced facial paralysis. This paper aims to demonstrate that this procedure is effective and causes negligible donor site morbidity.
Methods: Seven patients who developed facial paralysis after the removal of skull base tumors were treated with masseteric nerve transfer combined with cross-facial nerve grafting with the aim of reanimating the midface. The mean period of preoperative paralysis was 6 months. The follow-up period ranged from 22 to 65 months (mean: 46 months). The patients were evaluated with physical examinations and video analysis.
Results: Successful reanimation of the midface was achieved in all patients except one, whose muscle tone recovered. On average, facial motion developed 4 months after the nerve transfer. Only minimal coordinated eyelid movement was seen during biting. None of the patients experienced impaired masticatory function or visible wasting of the masseter muscle. All of the patients who recovered the ability to contract their paralyzed muscles were able to close their eyes tightly during biting; however, none of the patients have been able to achieve an effortless spontaneous smile.
Conclusions: Masseteric nerve transfer is an alternative method for selective reanimation of the midface and does not cause donor site morbidity.

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* Corresponding author. Department of Craniofacial Surgery & Plastic Surgery, Tominaga Hospital, 1-4-48 Minatomachi, Naniwa-ku, Osaka 556-0017, Japan. Tel.: +81 6 6568 1601; fax: +81 6 6568 1608.
E-mail address: Yoshioka0225@aol.com (N. Yoshioka).

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Introduction

When the facial nerve suffers a proximal injury during skull base surgery and the proximal stump of the facial nerve is not available for grafting, neurotization of the distal facial nerve is an appropriate treatment strategy. Several donor nerves are available for reanimating the face in such cases,[1,2] although the hypoglossal nerve is the most commonly used motor source.[3–6] As is the case for procedures involving other donor nerves, using the hypoglossal nerve to reanimate the face can result in various degrees of donor site morbidity.[5,6]

The use of the masseteric nerve, which innervates the masseter muscle, for facial reanimation was first described by Spira in 1978.[7] The masseteric nerve has since become the standard motor source for free muscle transplantations for bilateral congenital facial paralysis (MÖbius syndrome).[8–11] Moreover, it has been used as an alternative motor source for nerve transfers to the facial nerve during the treatment of short-term facial paralysis, and various other surgical procedures involving the use of the masseteric nerve have been reported.[12–17] The purpose of this study was to describe the author's facial reanimation strategy for patients with short-term facial paralysis, which involves using the masseteric nerve, together with its advantages and disadvantages.

Patients and methods

Between March 2009 and October 2012, 7 consecutive patients (all female) with ages ranging from 50 to 63 years (mean age: 57 years) were treated with masseteric nerve transfers to the upper trunk (temporofacial division) of the facial nerve combined with cross-facial nerve grafting, resulting in the dual innervation of their paralyzed muscles. The cross-facial nerve grafting between the bilateral zygomatic branches of the facial nerve was performed as a one-stage procedure. All of the patients had developed facial paralysis after the extirpation of a skull base tumor. Surgery was performed if there was no clinical or electrical evidence of facial nerve function at 6 months after the injury or as soon as possible if the facial nerve had been transected during a previous surgical procedure. The mean time between the onset of facial paralysis and the nerve transfer was 6 months.

Surgical technique

A preauricular skin incision was made on the affected side of the face, and a skin flap was elevated above the parotid fascia and extended to the anterior border of the gland (Figure 1). The retromandibular vein was used as a landmark to identify the upper trunk of the facial nerve.[18] After identifying the upper trunk of the facial nerve, the zygomatic and buccal branches were followed peripherally across the masseter muscle.

The masseteric nerve arises from the mandibular division of the trigeminal nerve and leaves the infratemporal fossa through the mandibular notch. It then passes into the masseter muscle from the muscle's medial surface via the space that is formed by the inferior border of the zygomatic arch superiorly and the mandibular notch inferiorly. Next, the nerve generally courses anteroinferiorly along the deep part of the masseter muscle. Therefore, the area that is formed by the inferior border of the zygomatic arch and the mandibular notch can be used as a palpable landmark for identifying the masseteric nerve.

Figure 1 Operative marking for the masseteric nerve transfer. X, which is the center of the area surrounded by the zygomatic arch above and mandibular notch below, indicates the point where the masseteric nerve was exposed. The zygomatic major muscle (red), parotid duct, and anterior margin of the masseter muscle are also indicated.

After dividing the masseteric fascia, the masseter muscle was bluntly divided along its fibers towards the deep part of the muscle. Dividing the muscle in the region between the zygomatic arch and mandibular notch exposes the section of the masseteric nerve running across the deep part of the muscle. Next, the nerve was dissected distally, and once an adequate length had been obtained, it was transected and transposed superficially. The masseteric nerve generally has two fascicles at this level and was coaptated to the upper trunk of the facial nerve in an end-to-end fashion with 10/0 nylon epineural sutures under a microscope. The lower trunk (cervicofacial division) of the facial nerve was left intact (see Supplemental Video 1, which demonstrates the surgical procedure).

Supplementary video related to this article can be found at http://dx.doi.org/10.1016/j.bjps.2015.02.031.

A 15–20 mm linear incision was made in front of the region formed by the inferior border of the zygomatic arch and the mandibular notch on the healthy side to allow the zygomatic branches of the facial nerve that are responsible for smiling to be identified (Figure 2). The exposed area is located anterior to the parotid gland and contains several zygomatic and buccal branches of the facial nerve. One or two zygomatic branches that move the corners of the mouth more than the ocular region during electrostimulation should be selected as donor nerves. It is also important to leave at least one adjacent synergic branch so that the functions of the facial muscles on the healthy side are not adversely affected. During this procedure, another team worked on the patient's leg to harvest the sural nerve for the cross-facial nerve grafting. Cross-facial nerve grafting was then carried out after a skin tunnel had been