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ORIGINAL ARTICLE

Facial reanimation by transposition of the masseter muscle combined with tensor fascia lata, using the zygomatic arch as a pulley

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Abstract

We have created a new way of reanimating the face, involving transposition of the masseter muscle combined with tensor fascia lata, and using the zygomatic arch as a trochlea to reconstruct the inferior facial paralysis. We used it on five patients who had facial palsy after excision of malignant parotid tumours. The wide skin defect that exposed the masseter muscle after total parotidectomy was reconstructed with a free flap. This method differs from those of other methods of transposing the masseter muscle in that force is applied at an upper lateral angle. Our method provided dynamic raising of the upper lip, the corner of the mouth, and the nasolabial fold in four patients. We consider it to be useful, particularly for prompt surgical reconstruction of facial palsy after total parotidectomy with a wide defect in the skin of the cheek.

Key Words: *Facial reanimation, masseter muscle transposition, zygomatic arch, trochlea*

Introduction

The temporalis muscle and the masseter muscle innervated by the trigeminal motor nerve are available to restore motion to an extensive area affected by paralysis of the facial nerve. The temporalis muscle is the most suitable for restoring a degree of movement and providing support for the eyelids. The temporalis muscle is also a good substitute motor for reanimation of the lower face. However, there is deformity associated with muscle bulk over the zygomatic arch with transposition of the temporal muscle. The masseter muscle is ideally located for reanimating the lower half of the face, and the principle underlying traditional transposition of the masseter muscle is that the muscle will pull the oral commissure and lips laterally and backwards when contracted [1–4]. In the muscle bow traction method, the masseter muscle and a fascial sling, sphincteric control, and buccinator replacement are substituted [5,6]. However, these methods are unable to raise the upper lip and corner of the mouth adequately, in particular upward movements of the nasolabial fold are insufficient. We have created another operation using transposition of the masseter muscle combined with tensor fascia lata and using the zygomatic arch as a pulley. Our method is similar to the temporalis muscle transfer method, and makes it possible to raise the nasolabial fold without deforming the muscle bulk.

Patients and methods

Patients

We operated on five patients, three men and two women, who had facial palsy after total parotidectomy. All the operations were done primarily. Patients' ages ranged from 59–72 years (mean 65) (Table I). The malignant parotid tumour was resected together with the skin of the cheek, and the zygomatic bone and masseter muscle were exposed. The free anterolateral thigh flap was used in four patients, and the free rectus abdominis myocutaneous flap in the other. The temporal

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Table I. Details of patients.

Case No.	Sex	Age (years)	Range of movement of commissure (mm)
1	Female	72	4
2	Male	65	7
3	Male	67	7
4	Male	59	3
5	Female	61	0

muscle was transposed to reanimate the paralysed eyelids in all cases.

Operation

The masseter muscle is approached externally through the skin defect after total parotidectomy. The preauricular incision could be extended to the temporal scalp, exposing the masseter muscle and zygomatic arch, and the incision is cosmetically acceptable. The anterior origin of the muscle is approached through an incision in the nasolabial fold. The anterior tendinous insertion of the masseter muscle is incised to preserve the tendinous fibres as they provide a strong attachment to which the tensor fascia lata may be sutured. The posterior third or anterior third of the muscle is raised from the zygomatic bone, and incised to mobilise it.

The lateral cheek is undermined and tunnels made from the zygomatic arch to the nasolabial fold, upper lip, commissure, and lower lip. The area around the zygomatic arch was carefully dissected to allow its use as a trochlea of the tensor fascia lata. A strip of the tensor fascia lata about 15 cm long is then harvested, and one end of the sling sutured to the masseter muscle that has been raised from the zygomatic bone. The other side is passed around the zygomatic arch, pulled through the tunnels and sutured to the nasolabial fold, upper lip, commissure, and lower lip (Figure 1). The nasolabial fold, corner of the mouth, and lip can be done by applying tension to the sling.

Results

The follow up period ranged from 10 to 21 months (mean 14.2). There were no postoperative complications. During follow up four of the five patients achieved dynamic facial reanimation. The range of movement of the oral commissure on the affected side was measured 10 months postoperatively. On clenching the jaws, the commissure moved 7 mm in two patients, 4 mm in one patient, and 3 mm in one patient. One patient could not move the upper lip, the corner of the mouth, or the nasolabial fold (Table I). However, there was no drooping of the commissure and lips, or drooling.

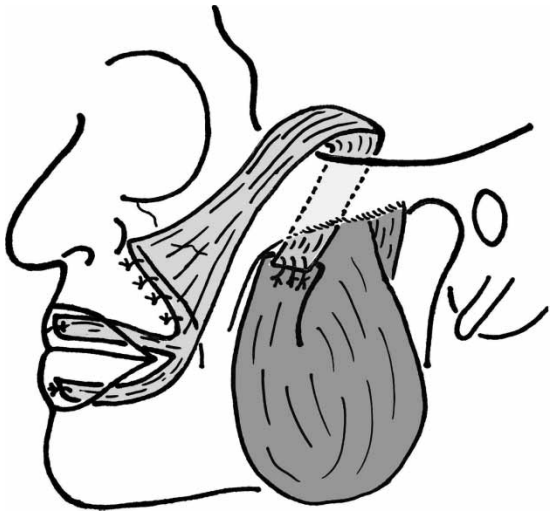

Figure 1. Diagram of the implanted fascial loop. The zygomatic arch is used as a trochlea.

Case reports

Case 1. A 65-year-old man had a malignant left parotid tumour. The temporal branch of the facial nerve was slightly paralysed on the left side (Figure 2*a*). He had total parotidectomy with radical neck dissection and primary reconstruction for his facial paralysis, during which the tumour was resected together with the skin of the cheek, and the zygomatic bone and masseter muscle were exposed. One end of the sling of tensor fascia lata was sutured to the masseter (Figure 2*b*), the other end being passed around the zygomatic arch (Figure 2*c*), and pulled through the subcutaneous tunnels (Figure 2*d*). This end was then sutured to the nasolabial fold, upper lip, commissure, and lower lip. The anterolateral thigh free flap was used for reconstruction of the skin defect. The patient was given radiotherapy postoperatively. Twenty-one months postoperatively he had dynamic movement of the nasolabial fold, upper lip, and lower lip by clenching his teeth to tense the muscle, which created a smile (Figure 2*e*, *f*).

Case 2

A 67-year-old man had a recurrent malignant left parotid tumour (Figure 3*a*). This was reconstructed primarily for facial paralysis after total parotidectomy (Figure 3*b*). One end of the sling of tensor fascia lata was sutured to the masseter muscle. The other end was passed around the zygomatic arch, and pulled through the subcutaneous tunnels (Figure 3*c*). This end was then sutured to the nasolabial fold, upper lip, commissure, and lower lip. The mandibular condyle was reconstructed with a titanium condylar prosthesis, and a free rectus abdominis myocutaneous flap was used for reconstruction of the cheek and

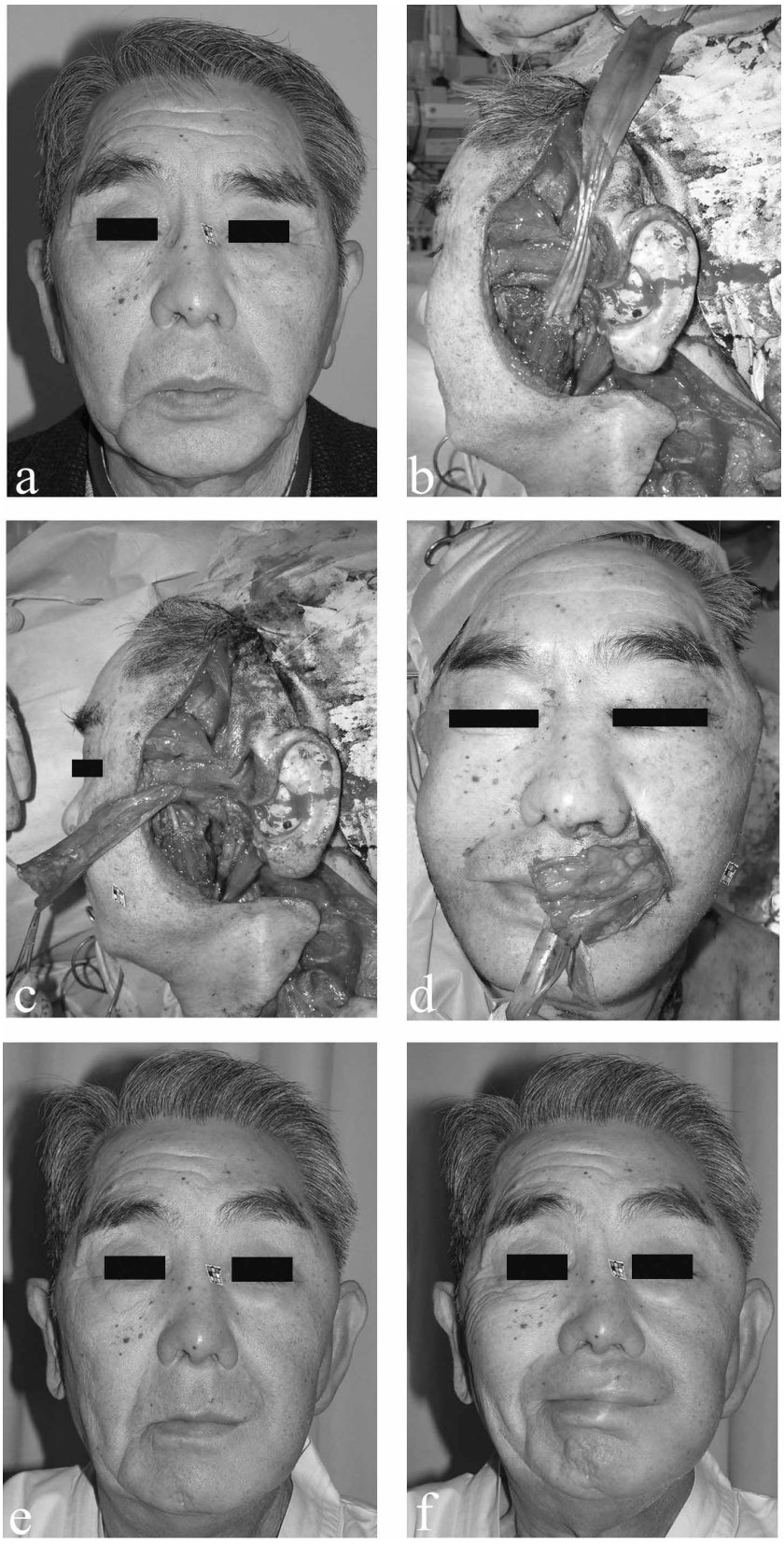

Figure 2. Case 1. (*a*) Preoperative photograph showing paralysis of the left temporal branch. (*b*) Intraoperative view. The masseter muscle has been raised and the strip of tensor fascia lata sutured to it. (*c*) The fascial strip is passed around the zygomatic arch. (*d*) Transposition to the upper lip, nasolabial fold, lower lip, and commissure. (*e*, *f*) Postoperative view. The patient is smiling by clenching his teeth.

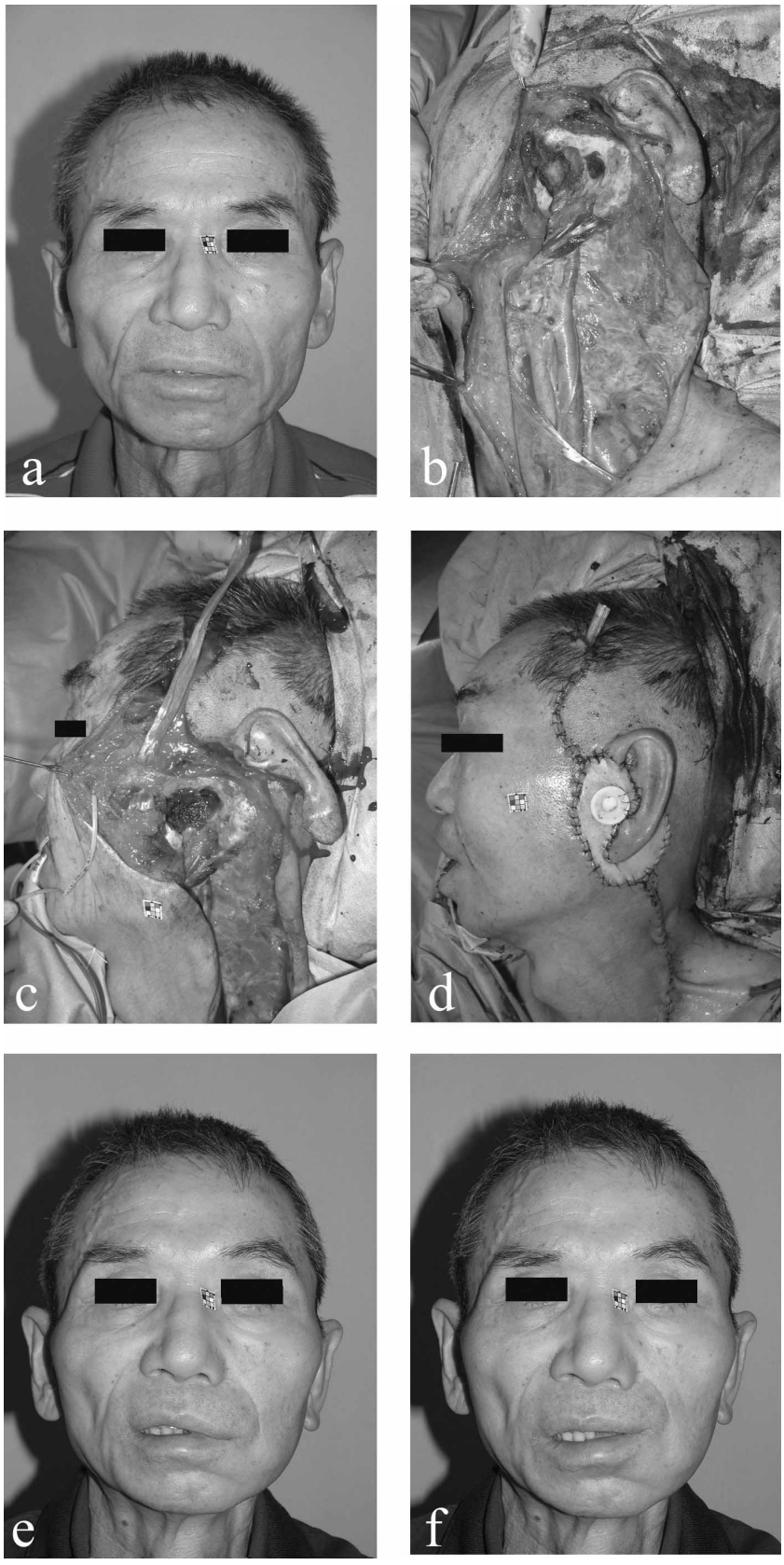

Figure 3. Case 2. (*a*) Preoperative condition. (*b*) Intraoperative view after total parotidectomy and neck dissection. (*c*) The fascial strip is passed around the zygomatic arch. (*d*) An intracanalicular stent is inserted as a retainer in the extra-auricular canal. (*e*, *f*) Postoperative view. Clenching of the teeth produced movement of the upper lip, nasolabial fold, lower lip, and commissure.

extra-auricular canal (Figure 3*d*). He was treated with postoperative radiotherapy and 14 months later his face was reanimated (Figure 3*e*, *f*).

Discussion

Temporalis or masseter muscle transpositions require extensive dissection, and the patient must relearn how to express the emotion desired [3–4,7]. Despite these, such transpositions provide a good substitute motor for dynamic facial movement. The muscle transpositions shorten the duration of postoperative rehabilitation, and the patient is encouraged to begin initial voluntary practice two or three weeks postoperatively to acquire new and automatic patterns of facial movement [4,8]. Nerve graft on the same side or cross-face nerve grafting offers hope for satisfactory recovery of facial function [9–12], but the rate of axonal regrowth is roughly 1 mm/day after the suture line has been crossed [13], and postoperative radiotherapy would damage axonal regrowth. Our patients experienced a quicker return of movement as well as a satisfactory response to postoperative irradiation.

De Castro Correia and Zani [14] noted that the neurovascular bundle of the masseter muscle, which arises from the mandibular nerve and internal maxillary artery, passes through the coronoid notch of the mandible, then runs obliquely forward and diagonally downwards across the rectangle of the muscle. To preserve the nerve supply, the muscle should be separated carefully, particularly at the posterior portion of the masseter muscle. Whole-muscle transposition is not necessary, but at least one third will be needed to give the muscle flap sufficient strength [4]. When the anterior third of the muscle is used for transposition, the risk of injury of the neuromuscular bundle is minimised.

Basic muscle movements of the cheeks and lips account for variations in the characteristics of the smile. According to Rubin [15], the human smile can be classified into three categories by the shape of the mouth. The zygomatic main dominant smile is the most common, and is produced by lifting the corners of the mouth. The canine smile, the second most common, is caused by the upper lip being raised by contraction of the levator labii superior. A full denture smile is the least common type; if new motor tendons are properly placed into paralysed sites and pulled in an adequate direction, facial movements of the unaffected side may be imitated. The direction and varying strengths of the movements of the new motor tendons affect the smile.

Patients who have a total parotidectomy that results in facial paralysis have a wide skin defect, and the masseter muscle and zygomatic arch are exposed. Additional incision of skin and dissection of the muscle are therefore minimal. However, the masseter muscle has not as much force and excursion as the temporalis muscle [16,17]. The maximum range of movement of the oral commissure on the affected side was 7 mm in our study, which is not sufficient to produce a full smile.

Reanimation with the upper lip and the corner of the mouth only is not sufficient for a full denture smile. A strip of anterior masseter muscle transferred from its insertion may, together with our technique, control the lower lip and corner of the mouth by a downward pull [18].

Our method has provided dynamic facial reanimation for four patients, and static reanimation for one patient. Failure to attain movement in the face may result from insufficient gliding of the strip of tensor fascia lata over the zygomatic arch. A long fascial strip is also used to lengthen the masseter muscle in our technique, but it may atrophy, slip, or stretch. However, recreation of the nasolabial fold and facial symmetry at rest were restored to the patient. There was no drooling and the patient was satisfied with the result.

In conclusion, our method is useful, particularly for prompt surgical reconstruction of lower facial palsy after total parotidectomy with a wide skin defect in the cheek, particularly for older and infirm patients [8].

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