Muscle Bow Traction Method for Dynamic Facial Reanimation

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A muscle bow traction method was developed for dynamic facial reanimation utilizing the masseter muscle and a fascial sling. The principle of this method is that the sling around the muscle pulls the oral commissure laterally and backward by the restoring force of the muscle from its relaxed position to its contracted position. The surgical procedure is simple. The sling is passed around the anterior half of the muscle so that the muscle can be bowed anteriorly at its center by the sling. One end of the sling is sutured to the center of the orbicularis oris and the dermis in front of the nasolabial fold, and the other end is sutured to the lower lip and oral commissure. This method was applied to 3 patients with facial palsy and to 1 patient with oral cancer. The restored motion of the oral commissure ranged from 5 to 8 mm when clenching the jaws. The concept of this method differs from those of other muscle transposition methods for facial reanimation in that the force acts at a right angle to the muscle contraction. The advantage of this method is that it is less invasive to the muscle and is a simpler procedure than other conventional muscle transposition methods.

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A muscle bow traction method was first developed by the senior author (MS) for facial reanimation utilizing the masseter muscle and a fascial sling. The principle of this method is that the sling around the muscle pulls the oral commissure laterally and backward by the restoring force of the muscle from its relaxed position to its contracted position; that is, the muscle draws back from its bowed position to the original position like a bow when released. The concept of this method differs from those of other muscle transposition methods[1–5] for facial reanimation in terms of the force acting at a right angle to the muscle contraction. We present the surgical procedure and applications of this method.

Materials

This method was used on 2 patients with facial palsy following excision of a cerebellopontine-angle tumor, 1 patient with facial palsy after total parotidectomy, and 1 patient with oral cancer who underwent wide excision of the tumor involving the oral commissure (Table).

Surgical Procedure

A skin incision is made along the nasolabial fold. In two of the patients with facial palsy a spindle-shaped excision was made to remove redundant skin. Subcutaneous dissection of the muscle through the incision proceeds laterally and backward to expose the anterior half of the muscle. If the approach is made through a small nasolabial skin incision only, a preauricular skin incision may be added to obtain good exposure of the muscle. A strip of tensor fascia lata approximately 15 cm in length is then harvested, and the strip is passed through the wound and around the anterior half of the muscle. One end of the sling is sutured to the center of the orbicularis oris and the dermis in front of the nasolabial fold and the other is sutured to the lower lip and oral commissure. The sling comes around the anterior half of the muscle so that the muscle can be bowed anteriorly at its center by the fascial sling traction (Fig 1A). Overcorrection of the lip is always necessary by tension of the sling, and adequate range of motion of the oral commissure should be checked by muscle contraction using a muscle stimulator during surgery. The commissure moves laterally and backward by the restoring force of the muscle when it contracts (Fig 1B). We teach the patients to clench their jaws when smiling.

Patient Reports

Patient 1

A 57-year-old woman developed right facial palsy following resection of a parotid gland tumor. The

Patient Data

Patient	Age, yr	Sex	Original Disease	Range of motion of commissure, mm	Duration of follow-up, yr
KS	57	F	Right parotid tumor	5	2.5
IM	59	M	Right CPA tumor	7	5.3
IK	66	M	Right oral cancer	5	2.4
MT	67	F	Left CPA tumor	8	3.0

F = Female; M = Male; CPA = cerebellopontine angle.

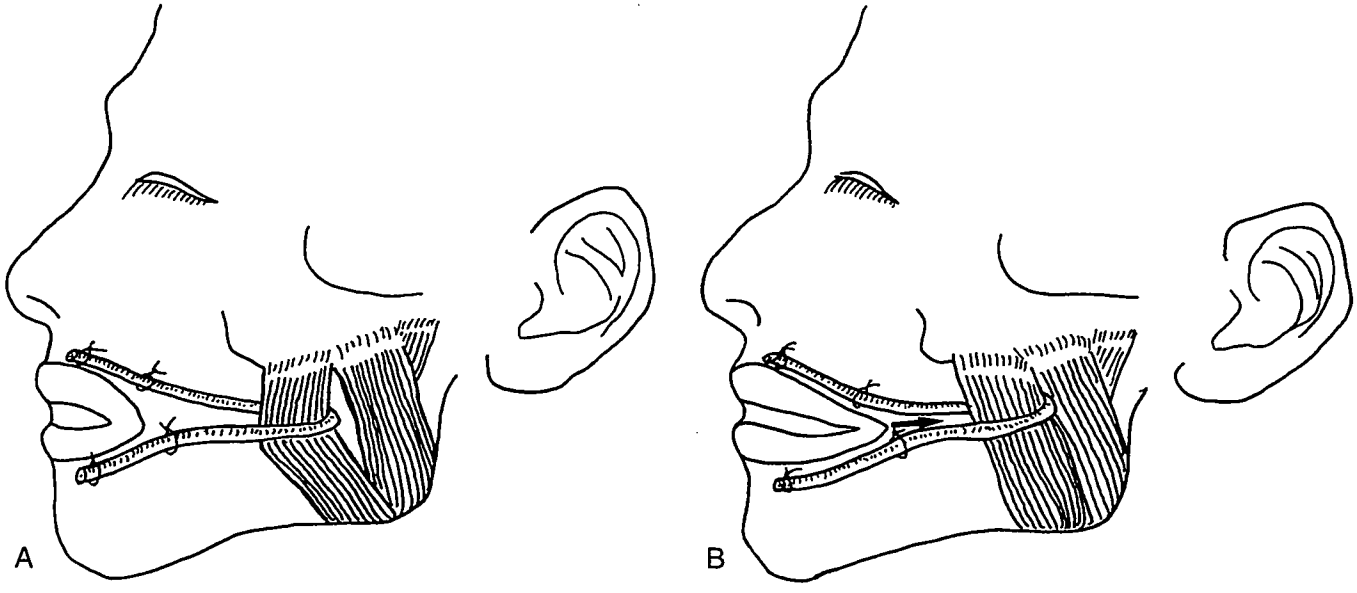

Fig 1. (A) Diagram illustrating the relationship of the oral commissure, the fascial strip, and the masseter muscle at rest. (B) Diagram illustrating the relationship of the oral commissure, the fascial strip, and the masseter muscle clenching the jaws. The oral commissure is pulled by the restoring force of the muscle.

patient saw us approximately 3 years after tumor resection and presented with severe facial palsy on the right side (Fig 2A). The muscle bow traction method was then planned for treatment of lower facial paralysis, suspension by a fascial slip for the right lower eyelid, and skin excision for the right eyebrow. A spindle-shaped skin incision was made on the right nasolabial fold. Through the incision a strip of fascia lata taken from the right thigh was passed around the anterior portion of the muscle (Fig 2D). Overcorrection of the oral commissure was performed by tension of the sling. The commissure moved 5 mm laterally and backward 1 year after surgery (Figs 2B, C). The patient is now waiting for a minor correction on the opposite side to create symmetry at rest.

Patient 2

A 67-year-old woman developed left facial nerve palsy following resection of a cerebellopontine-angle schwannoma. Cross-nerve grafting was performed on this patient 3 months after tumor resection, but the patient complained of drooling and drooping of the lower lip on the affected side for more than 1 year after the graft (Fig 3A). The muscle bow traction method was then planned to overcome these sequelae. The operation was performed under general anesthesia approximately 2 years after tumor excision. Two skin incisions were made along the left nasolabial fold and the left preauricular line to expose the masseter muscle. A strip of fascia lata approximately 15 cm in length was then passed around the anterior half of the muscle. The strip was sutured in a similar way to that in Patient 1. The commissure moved approximately 8 mm laterally and backward when clenching the jaws 3 years after surgery (Fig 3B, C).

Results

The range of motion of the oral commissure on the affected side was measured in the 4 patients 1 year after surgery. The commissure moved 8 mm

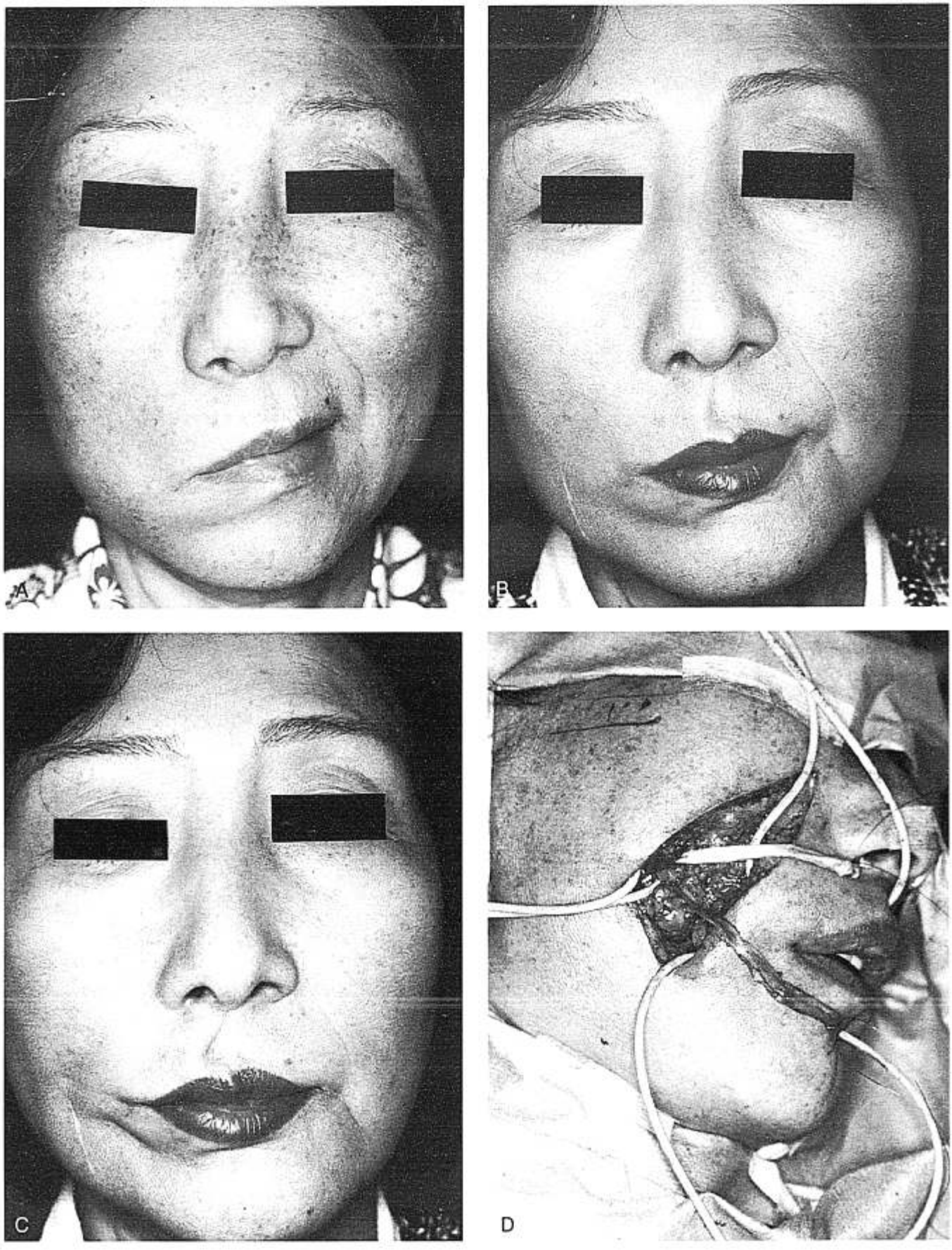

Fig 2. (A) Preoperative frontal view of a patient with right facial palsy. (B) Frontal view of the patient at rest 1 year after surgery. (C) Frontal view of the patient clenching her jaws 1 year after surgery. (D) The fascial strip is passed around the anterior half of the muscle.

Fig 3. (A) Preoperative frontal view of a patient with left facial palsy. (B) Frontal view of the patient at rest 3 years after surgery. (C) Frontal view of the patient clenching her jaws 3 years after surgery.

in 1 patient, 7 mm in 1 patient, and 5 mm in 2 patients when clenching the jaws (Table). Drooping of the lips and commissure, and drooling were improved in all the patients.

Discussion

The concept of the muscle bow traction method is quite unique because the power source of this method is the restoring force of the muscle from its relaxed position to its contracted position, and the direction of force is at a right angle to the direction of muscle contraction. To our knowledge this mechanism has not been applied to any case of dynamic reconstruction depending on muscle contraction.

The treatment of inferior facial paralysis by masseter muscle transposition is well accepted, but care needs to be taken when transposing to avoid injuries to the neurovascular bundle that supplies the muscle. De Castro Correia and Zani[4] reported anatomic observations of the muscle and noted that the height of the incision for transposition of the muscle should not be more than 3.5 cm to prevent injury to the masseteric nerve. Our method can minimize damage to the muscle and the nerve because the muscle is never freed from its insertion, and the sling of the fascia is only passed around the anterior half of the muscle at its center, with a minimum of muscle splitting. Therefore, we consider this method safer and simpler than the other muscle transposition methods,[1–5] but we have only 4 patients to present in this paper. We need to acquire more experience.

The maximum range of motion of the commissure was 8 mm in this study, which seems to be insufficient to create a natural appearance. In addition, regarding vector of pull, this method draws the oral commissure more laterally than a temporalis transfer. This is a limitation of the method.

In this series our method was applied to patients at least 1 year after they developed facial palsy. Sachs and Conley[6] reported the simultaneous use of cable graft and masseter muscle transposition for reanimation of the hemiparalyzed face. The purpose of their method was improvement of the immediate postoperative facial palsy and masseter-induced myoneurotization. Our method can improve facial palsy, but not myoneurotization. However, it is not yet known how much masseter-induced myoneurotization affects the paralyzed muscle. We can use cable grafts and our method only for the immediate amelioration of lower facial palsy.

Sawhney[7] described a technique of reanimating the reconstructed lower lip by complete masseter transposition and a fascia lata strip. We applied our muscle bow traction method to 1 patient with oral cancer who had undergone wide excision of the right half of the lower lip including the oral commissure, and this had been reconstructed using local flaps by oral surgeons. In the case of lip reconstruction following malignant tumor resection, we consider our method to be preferable because it is less invasive than whole-masseter transposition.

In conclusion, our muscle bow traction method was useful and easy to perform technically for dynamic facial animation in patients with lower facial palsy.

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