A Comparison of Temporalis Transfer and Free Latissimus Dorsi Transfer in Lower Facial Reanimation Following Unilateral Longstanding Facial Palsy

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Abstract: The ultimate goal in the treatment of facial palsy is the restoration of voluntary and spontaneous movement to the paralyzed side of the face, symmetrical to the normal side. We report our experience treating 40 patients with established facial palsy over a 4-year period. All patients underwent either temporalis transfer or free latissimus dorsi transfer as a single stage to improve lower facial symmetry. We believe that both techniques reliably achieve an increase of movement in facial reanimation after oncological, traumatic, or congenital facial palsy.

Key Words: facial palsy, reanimation, temporalis transfer, latissimus dorsi

(*Ann Plast Surg* 2005;54: 66–70)

The patterns of facial paralysis vary in the degree of involvement and duration, and a single surgical method can correct a complex combination of axonal and muscular degeneration. More than 100 years ago, Drobnik[1] performed an anastomosis of the spinal accessory nerve to the facial nerve in an attempt to restore facial expression. While the value of nerve transfer is recognized, it is of limited use in the treatment of longstanding nerve palsy due to the degeneration of motor end plates with time. In established facial palsy greater than 18 months duration, there is little chance of restoration of function following nerve repair alone.[2] Functional innervated muscle transfer is required to achieve facial reanimation. One of the simplest ways to achieve this is to transfer function from a muscle of mastication to substitute for muscles of facial expression. Free tissue transfer is a more technically demanding procedure, requiring neurorrhaphy and subsequent axonal ingrowth, but imports healthy tissue and a powerful muscle unit whose position can be easily adjusted. To date there is no comparative study between these 2 techniques.

Received December 9, 2003 and accepted for publication, after revision, June 24, 2004.

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ISSN: 0148-7043/05/5401-0066

DOI: 10.1097/01.sap.0000141378.23727.1a

MATERIALS AND METHODS

We retrospectively reviewed a cohort of patients during a 4-year period between 1999 and 2003, who underwent surgery to correct longstanding facial nerve palsy. During this time, 40 patients had surgery to improve oral function and symmetry. All had established complete lower trunk facial palsy of greater than 3 years duration. All were treated by the senior author and had either a temporalis transfer (TT) or free latissimus dorsi (LD) flap reconstruction as a single-stage procedure. These procedures were focused on restoration of the ability to provide a natural or near-natural smile. They were evaluated regarding symmetry and balance of facial tone at rest, sufficient muscle power upon voluntary contraction, synchronicity, and naturalness of expression upon emotional facial movements, especially upon smiling, and given a score according to the Harii's Grading Scale.[3]

All patients were followed up in the clinic postoperatively and were assessed by an unbiased independent experienced observer who graded the outcome. The preoperative score, with the complete and incomplete (no paralytic eye involved) seventh nerve palsies, was fixed as grade "0."

Operative Techniques

Our preferred method for TT was an intraoral approach, as described by McLaughlin in 1953.[4] The temporalis tendon was detached from the coronoid process and reattached, via strips of fascia lata, or palmaris longus, to the orbicularis fibers. The medial end of the muscle or fascial strips was pulled through deep subcutaneous tunnels and sutured into

the dermis of the melolabial fold so that this natural crease was recreated by the muscle pull. In the melolabial fold, the crease may be deepened to recreate contour by transposing a deepithelialized skin flap based on the line of the future melolabial fold[5] (Fig. 1).

In free tissue transfers, we used the technique of LD "single-stage" transfer as popularized by Harii et al.[3] The LD muscle was usually harvested on the same side as the paralyzed face. Through a preauricular skin incision on the paralyzed cheek, the cheek skin was widely raised above the parotid fascia to create a subcutaneous pocket to accept the subsequent muscle transfer. The lateral portion of the atrophied orbicularis oris muscle and the site of insertion of zygomaticus major and minor muscles into the orbicularis oris were also exposed. Another small incision was placed at the submandibular region to expose the facial artery and vein as the recipient vessels. Finally a small incision was placed at the anterior border of the parotid gland in nonparalyzed cheek, and several zygomatic and buccal branches are exposed. It is important to conserve adequate branches to zygomaticus major and levator labii muscles. These are best identified using a nerve stimulator. The harvested muscle segment was set into recipient site; its proximal end was fixed to the melolabial region. The thoracodorsal nerve was passed through the upper lip, and epineural sutures were placed. Microvascular anastomosis was performed between thoracodorsal vessels and recipient vessels, and finally the distal end of the muscle was fixed to the zygoma, ensuring appropriate muscle tension in the transferred muscle (Fig. 2).

RESULTS

During a period between February 1999 and October 2003, 40 patients were referred with unilateral facial nerve palsy. All patients had longstanding facial nerve paralysis greater than 3 years in duration. The average duration of paralysis before surgery was 5.5 years (range from 3 years to 15 years). Sixteen patients had satisfactory eye function, but all patients lacked lower facial nerve function, with absent oral competence on side affected. Twenty-nine patients underwent facial reanimation with TT, mean age 51.6 years (range 13 to 78 years), and 11 patients underwent LD reconstruction, mean age 31 years (range 10 to 53 years). The majority of facial palsies (16/40) were a consequence of radical parotidectomy for treatment of malignant tumors. Other common causes included trauma (8/40), congenital (8/40), acoustic neuroma (4/40), mastoidectomy (3/40), and 1 following previous excision of pontine vascular malformation. There were no obvious signs of muscle necrosis in either group, but 3 LD reconstructions required reexploration in

FIGURE 1. Schematic drawing of temporalis transfer with intraoral approach.

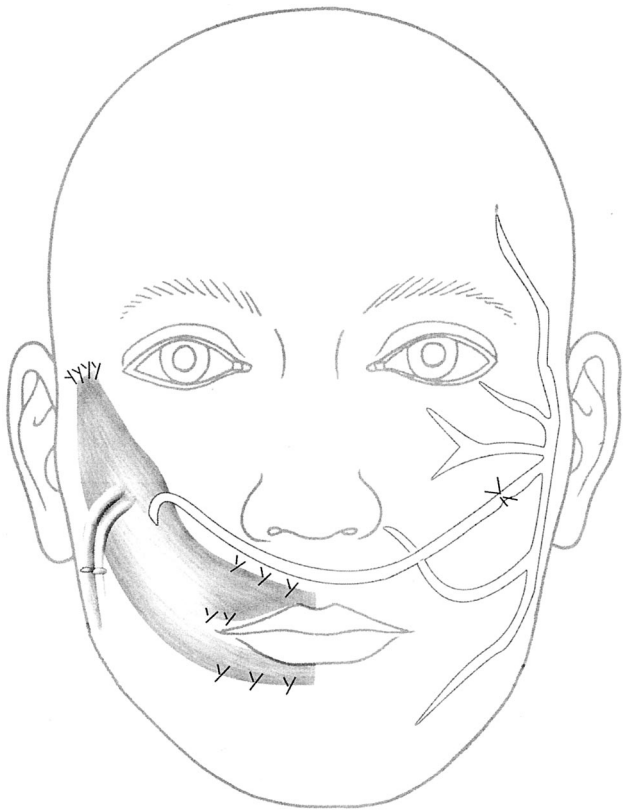

FIGURE 2. Schematic drawing of free latissimus dorsi transfer.

theater and evacuation of hematoma. Five patients who had LDs required further revision surgery to debulk muscle. The patients were followed up for an average of 18 months (range 3 to 60 months). Two patients from the TT group and 1 patient from the LD group were lost to follow-up.

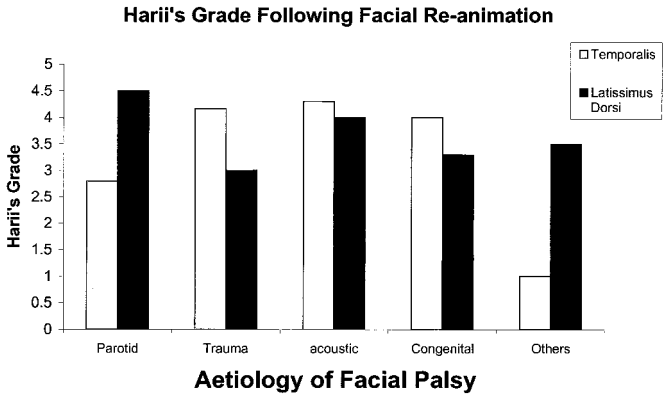

FIGURE 3. Summary of TT and LD transfers graded with Harii's Grading Scale.

Although the group which underwent LD reanimation had an average improvement in facial symmetry, muscle tone, and expression greater than in the group undergoing TT (Harii's grade 3.6 compared with 3.3), this was not statistically significant (Fig. 3).

DISCUSSION

The main aim in oral reanimation is to replace the voluntary and spontaneous function of lip-lifting muscles: zygomaticus major, levator labii superioris, and levator anguli oris.[6] The most common type of smile results from a dominant pull by the zygomaticus major, lifting the angle of the mouth with minimal or no counteraction from the depressors. More action and dominance from the levator labii superioris produces the "canine" smile. The "full-denture" smile is the least common, and it results from all the elevators and depressors of the lips and angle contracting. The platysma action is usually significant in this type of smile.[7]

FIGURE 4. Patient underwent temporalis transfer procedure after 3 years of facial palsy followed to excision of adenocarcinoma of left parotid gland. (**A**) Preoperative assessment, (**B**) Preoperative view after radiotherapy, (**C**) Postoperative result after 1 month, (**D**) Postoperative result after 12 months. Harii's score 4.

In our experience, TT alone can recreate these differing types of smiles by adjusting the insertion of the muscle using fascial strips. This procedure takes advantage of the fact that this muscle is innervated by the trigeminal nerve and the proximity of the temporalis muscle to the affected area.

The temporalis muscle is, however, of small volume and power following transfer, due to a change in the vector of muscle contraction and the fact that its vascularity and function may have been impaired during the primary injury or treatment. The movement is always associated with voluntary action of the masticator muscles initiated by clenching of the teeth. It may cause TMJ instability and unaesthetic appearance[8] and requires significant rehabilitation to achieve symmetry and avoid synkinesis. It remains, however, a relatively quick and low-cost procedure (Fig. 4).

Free muscle transfer may also be used for reanimation following a longstanding facial palsy.

Muscles have been employed after the first report by Thompson in 1971.[9] Several authors have recently considered the 1-stage method using vascularized free muscle transfers in which the motor nerve is crossed through the face and sutured to the contralateral facial nerve branches. Of these, the gracilis muscle reported by Kumar[10] in 1995, rectus femoris muscle reported by Koshima et al[11] in 1994, and more recently adductor magnus muscle by Eppley and Zuker[12] and obliquus internus abdominis muscle by Wei et al[13] in 2002 demonstrated satisfactory results.

We have chosen the LD mainly for anatomic reasons. When the muscle is transferred as a segment, the LD is the best choice as a parallel-fibered muscle. It gives a maximum isometric tetanic force when freely transferred with neurovascular repair.[14] When tension is developed in a parallel-fibered muscle, any shortening of the muscle is primarily the result of the shortening of its fibers. The fibers of LD muscle enable greater shortening of the entire muscle than is possible with a pennate arrangement and can move the muscle body segment through larger ranges of motion than comparably sized pennate-fibered muscle.[15] According to its anato-

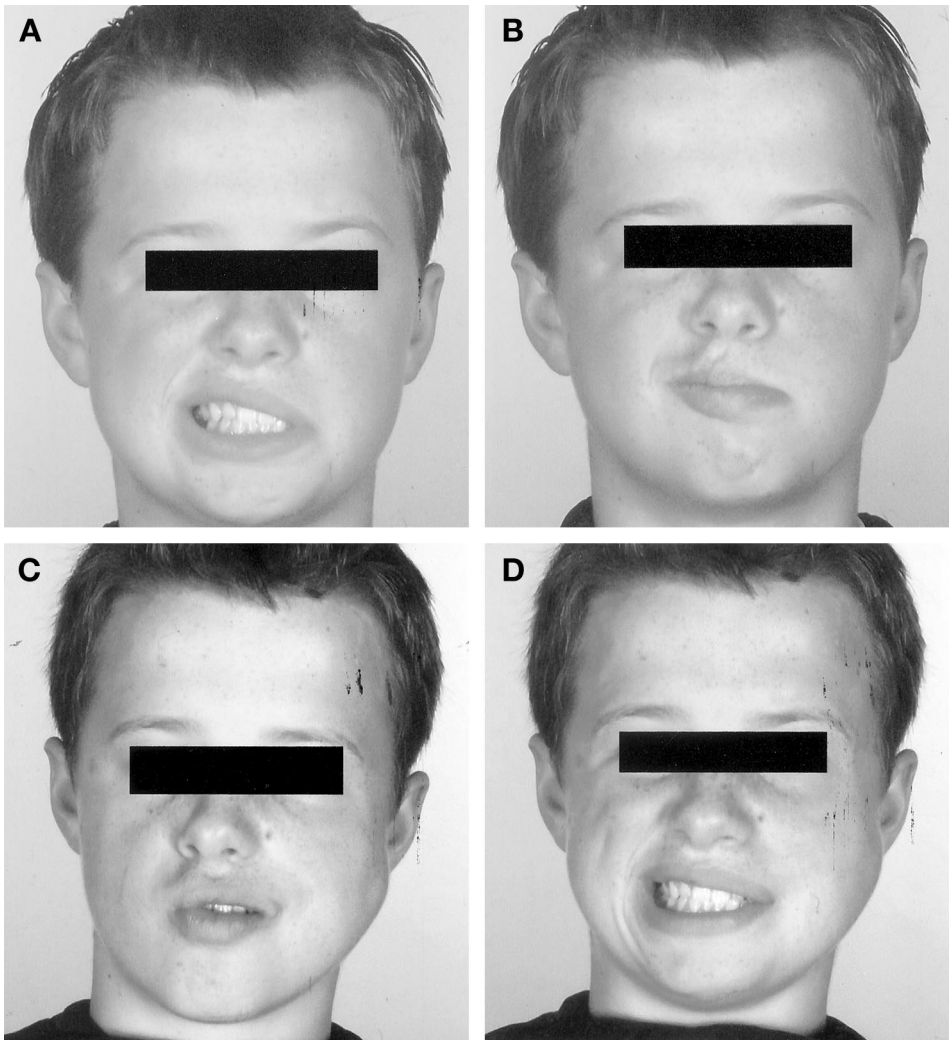

FIGURE 5. Patient underwent latissimus dorsi transfer for lower trunk seventh nerve reanimation, after 5 years of paralysis followed by congenital vascular malformation. (**A, B**) Preoperative assessment, (**C, D**) Postoperative result after 24 months. Harii's score 5.

my,[16–17] the excessive size and bulk can be reduced, splitting it into small muscle bellies. It should be taken into account that about 50% of the muscle transplanted will become atrophied after transfer, and the maximum working capacity is only one fourth of what is normal. Although excellent results can be accomplished using LD transfer, a single-stage procedure reanimation with LD requires neural ingrowth, and optimal facial mimicry is not achieved until 1 or 2 years following transfer. This makes it an unsuitable option in elderly patients with poorer prognosis or those in whom comorbid disease rules out a lengthy procedure. TT is a better and ideal reanimation for these patients as we expect some degree of movement of the face within weeks after surgery.

When using free muscle transfer to address facial palsy, we believe that a single-stage technique to restore facial reanimation should be the preferred option. This avoids the need for multiple procedures and multiple neurorrhaphy. Comparing the LD cases with TT cases, we saw less atrophy and more capacity of contraction with LD than with TT. The return of LD function requires ingrowth of motor neurons, a process which is not complete for many months. We therefore expect refinement of function to occur for a longer period. The insertion of the LD is also important; it should be placed in position of the zygomaticus major muscle to raise the corner of the mouth, 30 to 40 degrees to the horizontal, to produce a symmetrical smile (Fig. 5).

In our series of LD transfers, evidence of motor function was faster than we expected. We believe this is due to retained vascularity of the nerve from the thoracodorsal vessels.

Facial reanimation remains a surgical challenge. Differences between patients, etiology of paralysis, and previous treatments make a direct comparison between reconstructive techniques difficult. Both TT and LD transfer are valid techniques to achieve the goal of facial reanimation. Although in our series we have noted better function following LD transfer, it is a more lengthy procedure and is associated with a high return to theater rate for evacuation of hematoma. This is likely due to the fact that it has a large surface area of reshaped and buried muscle. Cheek bulk may be problematic, and revisional surgery to debulk the muscle is common. Careful patient selection is therefore critical. TT offers a more immediate improvement, albeit of lower final function. Therefore, in our practice TT is the preferred technique in more elderly patients in whom nerve regeneration is less predictable, in patients whose life expectancy may be reduced due to oncological reasons, and in those whose comorbid disease precludes a lengthy operation.

It is never possible to restore natural, spontaneous expression, complete motor power, and perfect synchronous movement with any operation. Nevertheless, single-stage muscle transfer offers the patient with longstanding facial palsy the possibility to regain voluntary movement and emotional expression with practice, adaptation, and awareness of his disability. We believe that this can be achieved with either TT or a single-stage LD transfer, depending on patient suitability.

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