Treatment of Facial Paralysis: Dynamic Reanimation of Spontaneous Facial Expression—Apropos of 655 Patients

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Background: Six hundred fifty-five cases of unilateral facial paralysis were treated by different surgical methods to achieve dynamic reanimation of facial muscle movement. In a retrospective study, the recovery of both truly spontaneous smile and facial muscle movement was evaluated independently.

Methods: The authors performed 505 two-stage gracilis, one rectus abdominis, and 14 single-stage latissimus dorsi microneurovascular muscle transfers, in addition to 28 cross-facial facial nerve neurotization procedures. These procedures were based on neurotization of the paralyzed region by the contralateral healthy facial nerve. Procedures involving motor nerves or muscle beyond the territory of the facial nerve included 73 temporalis muscle transpositions, four lengthening temporalis myoplasty procedures, 26 neurotizations by the hypoglossal nerve, and four neurotizations by the spinal accessory nerve.

Results: Patients treated by techniques based on the motor function of nerves other than the facial nerve did not recover spontaneous smile. Neurotization by the facial nerve, however, did result in the recovery of spontaneous smile in all satisfactory or better outcomes. Recovery of lip commissure movement based on neurotization by the contralateral healthy facial nerve was better than that of the remaining groups ($p < 0.0001$).

Conclusions: Temporalis muscle transposition and lengthening myoplasty are acceptable options for patients who are not good candidates for neurotization by the facial nerve. For the restoration of both truly spontaneous smile and facial muscle movement, free microneurovascular muscle transfer neurotized by the contralateral healthy facial nerve has become the authors' first-choice surgical technique. (*Plast. Reconstr. Surg.* 128: 693e, 2011.)

CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, IV.

The facial nerve, the seventh of 12 paired cranial nerves originating from the brainstem between the pons and medulla, neurotizes muscles of facial expression, such as happiness, sadness, anger, and others. Paralysis of the facial nerve creates asymmetry at rest. The asymmetry is exacerbated during smile and can hamper facial expression. This condition leads to both aesthetic and social communication difficulties for patients.

The ideal reconstructive result for the patient with unilateral facial paralysis is restoration of both a symmetric face at rest and the symmetric reanimation of a spontaneous smile.[1–3] Some authors have reported achieving both of these operative goals using surgical methods based on neurotization by nerves other than the facial nerve or transfer of muscles beyond the territory of the facial nerve after long-term biofeedback training.[4–6]

Different therapeutic methods for the treatment of facial paralysis were performed in a large series of patients. In this series of patients, surgical methods such as hypoglossal and spinal accessory nerve transfers to the facial nerve, or transposition of the temporal muscle, did not result in reanimation of spontaneous facial expression, although facial symmetry at rest was restored. In these techniques, the patients were required to

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clench their teeth, press their tongues, or move their shoulders to create a smile.[3,7,8] Spontaneous facial movement even after years of follow-up was not achieved in these groups of patients. However, microneurovascular muscle transplantation neurotized by the contralateral healthy facial nerve resulted in an optimal outcome.

PATIENTS AND METHODS

A total of 750 patients with unilateral facial paralysis were treated surgically from 1987 to 2007. Eighty-two patients treated in the early phase of paralysis by direct facial nerve repair or grafting and 13 cases treated by static facial sling were not included in this study. This retrospective study includes the remaining 655 patients with unilateral facial paralysis. Five hundred seventy-nine patients were diagnosed with longstanding paralysis (>1 year), and 76 patients included cases with an irreparable facial nerve by end-to-end coaptation or interposition nerve graft, although the period between the paralysis and operation was less than 1 year. Age, sex, cause, side of paralysis, and the interval between the onset of paralysis and surgical intervention were recorded. Preoperative evaluation and clinical photography were also performed. Operative time and events were recorded in detail. The results of the reconstruction of the paralyzed hemiface using the contralateral facial nerve (single- and two-stage muscle transfers, and cross-facial neurotization of the facial nerve) and the remaining procedures involving nerves or muscle beyond the territory of the facial nerve were compared statistically using the Mann-Whitney test. Separately, similar statistical comparisons were performed on the results of single-stage latissimus dorsi and two-stage gracilis muscle transfer.

Surgical Technique

Because two-stage free gracilis muscle transfer is the authors' preferred technique and the majority of the reported series were treated by this method, some important points in our routine procedure are mentioned, and the surgical techniques in other methods of treatment were relinquished. In the first stage of the operation, a sural nerve graft traversed the face through a subcutaneous tunnel passing under the uppermost part of the nasolabial line, and the distal end was coapted to the buccal branch of the facial nerve on the nonparalyzed side of the face using microscopic magnification and 10-0 nylon sutures, taking good care to not traumatize the palpebral branches. The other end of the graft was marked with a 3-0 nylon suture and placed subcutaneously near the tragus on the paralyzed side. The mean operative time was approximately 30 minutes. The Tinel sign progress along the course of the graft was monitored. The mean interval between the two stages of the operation was 12 months in adults and 9 months in children. In two cases, transient weakness of the palpebral branch on the nonparalyzed side was observed, which recovered spontaneously after a few weeks. There was no failure, and reoperation was never required.

The second stage was performed by two surgical teams. One surgeon harvested an 8 × 3-cm segment of gracilis muscle with a neurovascular pedicle. The muscle blood supply and segmental response to nerve stimulation were double-checked. The second surgeon simultaneously prepared the recipient area in the face and the facial artery and vein were explored. The distal end of the grafted sural nerve with a well-defined neuroma was released. The harvested muscle with its neurovascular pedicle was passed through a deep subcutaneous tunnel in the midface to a 2- to 3-cm incision exactly on the nasolabial crease. Suturing the muscle to the orbicularis oris was a critical part of the procedure. With the authors' experience, the nasolabial incision facilitated the exposure for precise attachment of the muscle and eliminated the need for vast facial dissection. This modification also provided the opportunity for correcting the asymmetry and sagging of the nasolabial fold. Patients did not complain of the resulting minute scar in the nasolabial crease. The other end of the muscle was fastened to the orbital rim and zygomatic arch, laterally. Finally, the artery and one vein were anastomosed and the nerve was coapted to the end of the sural nerve graft after neuroma excision using a surgical microscope and 10-0 nylon sutures. Operative time ranged from 120 to 150 minutes.

Postoperative Management

Patients who had undergone microvascular muscle transfer received 100 mg of acetylsalicylic acid daily for 10 days and were advised to consume a soft diet and limit talking for 20 days. Skin sutures were removed on postoperative day 7. All patients were referred to a rehabilitation center 2 months after the operation. Rehabilitation at this stage included light massage and electrical stimulation. In the free muscle transfer and neurotization cases, after observing the first movements, 3 to 4 months postoperatively, patients were instructed to repetitively exercise common facial expressions in front of a mirror to relearn facial movements (i.e., mirror biofeedback). For temporalis muscle transposition and myoplasty, relearning facial movement started earlier, after 2 months.

Follow-Up

The follow-up period was 1 to 20 years. The results of treatment and any complications, further revisions, or additional operations were recorded. Numerous scales for evaluation of the repair of unilateral facial paralysis have been proposed, including recovery of symmetry at rest and smiling, muscle bulk, independent muscle movement, elevation of the nasolabial fold, closure of the mouth, and involuntary muscle movements. However, in this retrospective study, a simplified objective classification of commissure maximal-lateral movement for evaluation of recovery of spontaneous facial muscle movement was used. Recovery of spontaneous smile was classified into two groups: positive and negative. Recovery of the maximal lateral movement was evaluated quantitatively by measuring maximal lateral movement recovery of the paralyzed oral commissure. Regarding attachment points and direction of the transferred muscle, lateral movement of oral commissure up to 2 cm is the ultimate expected final result. This is the basis for the classification or scoring system developed for this study. The quantitative evaluation was used to categorize the results into four groups of excellent (≥2-cm commissure movement), good (1.5- to <2-cm movement), satisfactory (<1.5-cm lateral movement), and failed (<1-cm movement) (Table 1). The group with good maximal lateral movement may exhibit perfect symmetry during mild smiling; however, degrees of asymmetry become apparent during a full smile. An assessment of the patients was performed 1 year after the operation. However, a large number of patients have been followed up for longer periods of up to 25 years.

Table 1. Classification System

Final Outcome Assessment	Oral Commissure Symmetry at Rest	Maximal Lateral Movement of Commissure on the Paralyzed Side
Excellent	Nearly full symmetric	≥2 cm
Good	Mild asymmetry	1.5–2 cm
Satisfactory	Moderate asymmetry	1–1.5 cm
Failed	Severe asymmetry	<1 cm

RESULTS

Of 655 patients included in this study, 304 were male (46.4 percent) and 351 were female (53.6 percent). The ages of the patients ranged from 3 to 72 years, with an average of 25.7 years at the time of the first operation. Right facial paralysis was observed in 328 (50.1 percent) and left paralysis was observed in 327 patients (49.9 percent). The interval between paralysis and first operation ranged from 3 months to 51 years, with an average of 15.9 years (Table 2).

All patients suffered a longstanding facial palsy or a complete injury to the facial nerve that clinically was evaluated as irreversible and irreparable either directly or by means of interposition nerve grafting. The cause of facial palsy was developmental in 350 (53.4 percent); tumor resection surgery (iatrogenic) in 131 (20.0 percent); trauma in 109 (16.6 percent), including 25 (3.8 percent) war injuries; and Bell palsy in 65 patients (9.9 percent) (Table 3).

Results Based on Maximal Lateral Movement of the Oral Commissure

Two-stage free muscle transfer was performed in 506 patients, including 505 gracilis muscle transfer that resulted in 71 (14 percent) with excellent, 384 (76 percent) with good, 40 (8 percent) with satisfactory, and 10 (2 percent) with bad recovery (Figs. 1 through 4). The results of this

Table 2. Demographic Data

Characteristic	Value (%)
Total no. of patients	655
Age, years	
Average	25.7
Range	3–72
Sex	
Male	304 (46.4)
Female	351 (53.6)
Side	
Right	328 (50.1)
Left	327 (49.9)
Paralysis-to-surgery interval	
Average	15.9 yr
Range	3 mo–51 yr

Table 3. Cause of Facial Palsy

Cause	Value (%)
Developmental	350 (53.4)
Tumor surgery	131 (20.0)
Traumatic	109 (16.6)
Bell palsy	65 (9.9)

Fig. 1. An 18-year-old patient is shown preoperatively (*above*) with complete iatrogenic unilateral left facial paralysis and (*below*) 2 years after the second-stage free gracilis muscle transfer. The result is evaluated as excellent, with symmetric and spontaneous smile.

Fig. 2. (*Above*) Preoperative image of a 6-year-old patient with congenital left facial paralysis treated by two-stage gracilis muscle transfer. (*Below*) The same patient is shown 1 year after the second stage of the operation. The result is evaluated as excellent, with symmetric and spontaneous smile.

technique were compared in three age groups of 3 to 15 years, 15 to 25 years, and older than 25 years. Although the results in the 15- to 25-year age group appeared better than in the remaining groups, the Kruskal-Wallis statistical test did not indicate a statistically significant difference between the results of the three age groups ($p = 0.070$) (Table 4). Surgical complications included 12 cases of immediate postoperative thrombosis treated by repeating anastomosis, six cases of facial hematomas treated by drainage, and five cases of hypertrophic scars. In a paraplegic patient, the rectus abdominis muscle was transferred with good outcome.

Single-stage free latissimus dorsi muscle transfer was performed in 14 patients, with 12 good (86 percent) and two satisfactory outcomes (14 percent). Temporalis muscle was flipped downward to support the lower face in 73 patients, with 22 good (30 percent), 43 satisfactory (59 percent), and eight failed outcomes (11 percent) (Fig. 5). Temporalis muscle was slid downward and reinserted to the orbicularis oris muscle in four patients, with satisfactory results. Cross-facial nerve grafting was carried out in 28 patients, with good results in 10 (36 percent), satisfactory results in 16 (57 percent), and failed results in two patients (7 percent) (Fig. 6). The hypoglossal nerve was transferred in 26 patients and the spinal accessory nerve (Fig. 7) was transferred to the severed facial nerve in four patients. Neurotization by the hypoglossal nerve resulted in 15 good (58 percent) and 11 satisfactory outcomes (48 percent). Neurotization of the facial nerve by the spinal accessory nerve resulted in one good (25 percent) and three satisfactory outcomes (75 percent) (Table 5). The results of the repair of facial paralysis by techniques based on neu-

Fig. 3. (*Above*) Preoperative view of a 15-year-old patient with right congenital facial paralysis. (*Center*) Appearance after two-staged gracilis muscle transfer 1 year after the operation. The patient is satisfied with the results of excellent restoration of spontaneous facial expression. (*Below*) At postoperative year 5, a slight bulking of the right cheek that has developed gradually is observable. This patient did not volunteer for a defatting procedure.

Fig. 4. A 12-year-old patient with congenital left facial paralysis treated by two-stage gracilis muscle transfer before surgery (*above*) and 1 year after the second stage of the operation (*center* and *below*), with good recovery of spontaneous smile.

rotization by the contralateral facial nerve (single- and two-stage free muscle transfer and cross-facial

Table 4. Results of Two-Stage Gracilis Muscle Transfer According to Age*

Age	No. of Patients (%)	Excellent (%)	Good (%)	Satisfactory (%)	Failed (%)
3–15 Years	65 (13)	7 (10.8)	50 (76.9)	7 (10.8)	1 (1.5)
15–25 Years	172 (34)	32 (18.6)	127 (73.8)	10 (5.8)	3 (1.7)
>25 Years	268 (53)	32 (11.9)	207 (77.2)	23 (8.6)	6 (2.2)
Total	505 (100)	71 (14)	384 (76)	40 (8)	10 (2)

*The Kruskal-Wallis test did not indicate a statistically significant difference in the results based on the three age groups in this series of patients ($p = 0.070$).

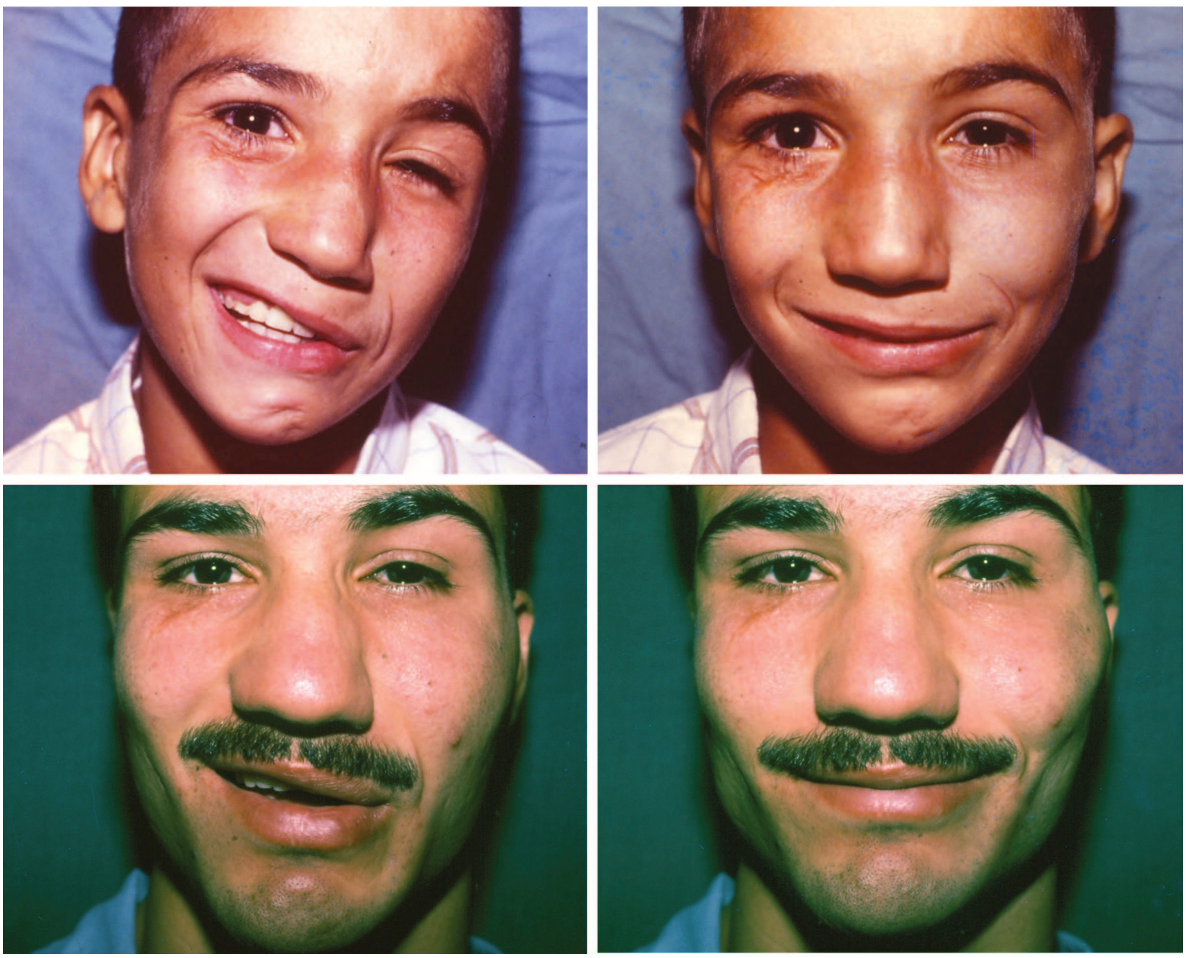

Fig. 5. (*Above*, *left*) Postoperative smile of a 7-year-old patient with left developmental facial paralysis treated by temporalis muscle transfer. He is shown without clenching his teeth. The patient is not able to produce a symmetric smile without his clenching teeth. (*Above*, *right*) Postoperative symmetric facial muscle movement induced by teeth clenching. (*Below*, *right*) The same patient 20 years later shows that he has not been able to adapt a symmetric truly spontaneous smile without teeth clenching. (*Below*, *right*) Twenty years postoperatively, the patient is obliged to clench his teeth to display a symmetric smile.

nerve grafting) were statistically better than the results obtained by transfer of muscles or nerve beyond the territory of the facial nerve ($p <$ 0001) (Table 6).

Results Based on Recovery of a Truly Spontaneous Smile

For evaluation of the recovery of a truly spontaneous smile, only recovery of satisfactory or better commissure movement was considered. Healthy facial nerve was used as the neurotization source in gracilis, rectus abdominis, latissimus dorsi muscle transfers, and cross-facial nerve grafting groups. All patients who did not fail (536 patients) recovered spontaneous true smile. None of the patients (108 patients) in the groups neurotized by nerves

Fig. 6. (*Above*) A 3-year-old patient with left iatrogenic facial paralysis after retroauricular tumor resection was treated by a single cross-facial nerve graft from the buccal branch of the healthy side to the main trunk of the paralyzed facial nerve 3 months after the onset of the paralysis. Left medial tarsorrhaphy performed by an ophthalmologist before referral is observable. Postoperative results at 4 years (*center*) and 18 years (*below*) are shown. The patient is able to produce a spontaneous smile; however, facial muscle force on the repaired side is evaluated as good. Tarsorrhaphy was released after paralysis recovery without the need for any additional procedures for reanimation of the left eye sphincter.

other than the facial nerve or temporalis muscle transfer was able to achieve a truly spontaneous smile.

DISCUSSION

Different methods have been presented for treatment of the paralyzed face, and many of them after some refinements and modifications still have their indications, depending on the patient's general condition and the surgeon's capabilities. These techniques, including cross-facial neurotization of the facial nerve by sural nerve grafting, temporalis muscle transfer, neurotization by hypoglossal or spinal accessory nerve, and free muscle transfers, have been performed in this series of patients, and a comparative study is presented in this article.

Cross-facial nerve grafting was performed in 28 patients in the first 6 months of paralysis. The procedure can result in a symmetric and spontaneous smile. However, in our series of patients, the final result was unpredictable. It was good only in children younger than 5 years, and both of the two failed cases were older than 20 years (Fig. 6).

The early attempts at dynamic reanimation of the paralyzed face involved transfer of a cranial nerve such as the hypoglossal, spinal accessory, or masseteric nerve to the facial nerve. These methods should be performed in the first months after paralysis.[9–13] During the first years of this study, 26 cases of hypoglossal-to-facial transfer and four cases of spinal accessory–to-facial transfer were performed by the first author (J.G.). In the hypoglossal group, all of the patients suffered from deviation and hemitongue atrophy. In addition, patients had to push their tongue against their lower teeth to induce a smile. Twelve of these patients had synkinesia and concomitant unilateral eye closure during smiling; therefore, they tried to close both eyes during smiling to show better facial symmetry. Dealing with this complication, in a secondary operation, the ophthalmic branch of the facial nerve on the paralyzed side was divided and neurotized by a cross-facial nerve graft from a branch of the contralateral ophthalmic nerve in three patients. Similarly, in the spinal accessory transfer

Fig. 7. A 15-year-old war injury patient had right facial nerve damage caused by the impact of a bullet at the mastoid portion of the temporal bone 5 months before referral. The patient was treated by neurotization by spinal accessory nerve. (*Left*) Preoperative view of the patient with right facial paralysis. (*Right*) Trapezius muscle atrophy is observable 2 years after the operation. The patient has to raise his shoulder to produce a symmetric smile.

Table 5. Final Results of Different Surgical Techniques

	No. of Patients	Excellent (%)	Good (%)	Satisfactory (%)	Bad/Failed (%)	Involuntary Truly Spontaneous Smile Satisfactory or Better (%)
Gracilis muscle transfer	505	71 (14)	384 (76)	40 (8)	10 (2)	495/495 (100)*
Rectus abdominis muscle transfer	1	—	1 (100)	—	—	1/1 (100)*
Latissimus dorsi muscle transfer	14	—	12 (86)	2 (14)	—	14/14 (100)*
Cross-facial grafting	28	—	10 (36)	16 (57)	2 (7)	26/26 (100)*
Temporalis muscle transfer	73	—	22 (30)	43 (59)	8 (11)	0/65 (0)†
Lengthening temporalis myoplasty	4	—	—	4 (100)	—	0/4 (0)†
Neurotization by hypoglossal nerve	26	—	15 (58)	11 (42)	—	0/26 (0)†
Neurotization by spinal accessory nerve	4	—	1 (25)	3 (75)	—	0/4 (0)†

*Neurotization by contralateral facial nerve.
†Motor nerve beyond the territory of the facial nerve.

Table 6. Neurotization by the Contralateral Facial Nerve and Neurotization or Muscle beyond the Territory of the Facial Nerve Cross Tabulation*

	No. of Patients	Excellent (%)	Good (%)	Satisfactory (%)	Failed (%)
Neurotization by the contralateral facial nerve	548	71 (12.9)	407 (74.3)	58 (10.6)	12 (2.2)
Neurotization or muscle beyond the territory of the facial nerve	107	0 (0.0)	38 (35.5)	61 (57.0)	8 (7.5)

*The Mann-Whitney *U* test indicates a statistically significant difference between neurotization by contralateral facial nerve and neurotization or muscle beyond the territory of the facial nerve results ($p < 0.0001$).

procedure, atrophy of the trapezius muscle was observed. These patients were obliged to elevate the shoulder to induce a facial movement on the paralyzed side of the face (Fig. 7). Several modifications for hypoglossal nerve transfer such as interposition nerve grafting,[14] end-to-side nerve coaption,[15] and splitting of the hypoglossal nerve[16,17] were used to reduce some of these drawbacks; however, these modifications did not result in restoration of spontaneous smiling. In our series of patients, no degree of cortical adaptation to produce a spontaneous smile occurred.

Because of these unsatisfactory consequences, the authors abandoned nerve transfer techniques in favor of other methods such as temporalis muscle transposition and microvascular free muscle transfer. Seventy-three standard flip-over partial temporalis muscle transpositions[4,18,19] resulted in good and satisfactory outcomes in the majority of the patients in terms of recovery of facial symmetry; however, none of the patients was able to recover dynamic spontaneous movements and had to clinch their teeth to make a symmetrical smile even after 20 years of follow-up (Fig. 5). In addition, a large number of patients were unsatisfied with the aesthetic consequences of this procedure. Recently, we performed lengthening temporalis myoplasty for lip reanimation in four patients. Some authors present that degrees of cortical adaptation after biofeedback training occurs in some patients to express a spontaneous smile.[6,20] This technique results in acceptable aesthetic outcomes; however, we did not observe any spontaneous movements after 2 to 3 years of follow-up. The optimal results of microvascular free muscle transfer encouraged us to choose this technique as our standard practice not only for longstanding unilateral facial paralysis but also for cases with less than 1 year of paralysis. We reserved temporalis muscle transfer or lengthening myoplasty for patients who were not appropriate candidates for the two-stage procedure.

Several muscles have been used for microvascular free transfer in facial paralysis, including gracilis,[21] pectoralis minor,[22] latissimus dorsi,[23] rectus abdominis,[24] extensor digitorum brevis,[25] rectus femoris,[26] serratus anterior,[27] palmaris longus,[28] internal oblique,[29] and abductor hallucis.[30] The gracilis muscle is probably the most commonly used muscle for the procedure. Harvesting the muscle is straightforward and can be performed by a surgeon while another team prepares the recipient site for the transfer. Donor-site complications are few and no functional deficit after the gracilis harvest has been reported.[3,31] The gracilis muscle is supplied by the anterior branch of the obturator nerve. This nerve is not long enough to reach the other side of the face; therefore, in this group of 505 patients, cross-facial nerve grafting and two-stage surgery were mandatory. Single-stage transfer of the gracilis muscle to the paralyzed face by means of extended and intraneural nerve dissection has been reported.[32,33] Kumar and Hassan compare their results of single-stage and two-stage free gracilis transfer in 25 patients. The results of single- and two-stage operations were comparable, except that better symmetry at rest was recorded following the two-stage method.[34] Single-stage gracilis muscle transfer was not performed in our series of patients. However, latissimus dorsi muscle was transferred in 14 patients in a single-stage operation. First muscle contraction was observed 5 to 7 months postoperatively. The long-term results were good in 86 percent and satisfactory in 14 percent of patients, which is statistically comparable to the two-stage transfer of gracilis, with 14 percent excellent, 76 percent good, and 8 percent satisfactory results ($p = 0.165$) (Table 7). The advantage of neurotization by grafted sural nerve 1 year after the primary operation is that the transferred muscle neurotization starts 3 months after the operation. Although our data do not indicate a statistically significant difference between the results of single- and two-stage procedures, we believe that shortening the period between muscle transfer and recovery of muscle contraction improves the results, as confirmed by comparing a 14 percent excellent outcome in the two-stage category and no excellent result in the single-stage latissimus dorsi muscle transfer group.

Obviously, it is impossible to recreate delicate and complex function of the hemifacial musculature by transferring a single muscle. A realistic goal of muscle transfer is functional restoration of the zygomaticus major muscle, which is the most important muscle in creating a smile. The zygomaticus major muscle is approximately 6.5 cm in length and shortens to 2 cm in full contraction.[35] Therefore, free transfer of a partial segment of a muscle such as the gracilis, centered on a neurovascular pedicle, is a good replacement for reanimating zygomaticus major muscle contraction.

Table 7. Two-Stage Gracilis and Single-Stage Latissimus Dorsi Muscle Transfer Cross-Tabulation*

	No. of Patients	Excellent (%)	Good (%)	Satisfactory (%)	Failed (%)
Two-stage gracilis muscle transfer	505	71 (14.1)	384 (76.0)	40 (7.9)	10 (2.0)
Single-stage latissimus dorsi muscle transfer	14	0 (0.0)	12 (85.7)	2 (14.3)	0 (0.0)

*The Mann-Whitney U test did not indicate a statistically significant difference between the single-stage latissimus dorsi and two-stage gracilis muscle transfer procedures ($p = 0.165$).

CONCLUSIONS

There are some reports on cerebral adaptation and degrees of spontaneous smile with nerve transfers to the paralyzed facial nerve or transfer of muscles beyond the territory of the facial nerve such as temporalis or masseter to the lip, and free muscle transfer neurotized by nerves other than the facial nerve such as the masseteric nerve. However, this phenomenon did not occur in any of the patients treated by these techniques. Therefore, for the restoration of both truly spontaneous smile and facial muscle movement, free muscle transfer neurotized by the contralateral healthy facial nerve has become our first-choice surgical technique. Based on the results of this retrospective study, temporalis muscle transfer and lengthening myoplasty are acceptable options for patients who are not appropriate candidates for neurotization by the contralateral healthy facial nerve.

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PATIENT CONSENT

Patients provided written consent for the use of their images.

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