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Temporalis Muscle Transfer for Long-Standing Facial Paralysis

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ABSTRACT

Background: Facial paralysis is the most common pathology of the cranial nerves. The most reliable muscle transfers presently being used include the temporalis and masseter transfers. The aim of this study is to evaluate the clinical usefulness of transposition of the temporalis muscle in treating long-standing facial palsy.

Methods: Ten patients attended the outpatient clinic of Plastic Surgery Department at Assiut University Hospital between April, 2014 and May, 2015 with unilateral longstanding facial nerve paralysis. Temporalis muscle transfer used for correction of eye and mouth movements to improve facial symmetry at rest as well as to recreate a new smile.

Results: Patient satisfaction was moderate to high. Patients photographs were generally evaluated as good. There was no donor site morbidity noted after the surgery.

Conclusion: Using temporalis muscle transfer for correction of eye closure in patients with longstanding facial paralysis is superior to other classic methods.

Key Words: *Temporalis – Facial nerve – Facial paralysis.*

INTRODUCTION

Facial paralysis is the most common pathology of the cranial nerves with an incidence ranging from 20 to 30 cases per 100.000 people per year **[1]**. The facial nerve gives off several branches in the face which are responsible for providing the facial tone and movement necessary for ocular protection, nasal air-flow, articulation of speech and oral continence. Damage to the facial nerve may cause imbalance of the face at rest as well as distorted, asymmetrical facial expressions (e.g. smiling, laughing, grimacing, etc.). Functionally, facial nerve injury affects chewing, fluid retention while drinking, nasal breathing, corneal exposure, speech patterns, and communication skills **[2]**.

In cases where there is muscle atrophy due to long standing facial paralysis, in order to establish facial movements, viable muscles and nerves are detached from a donor site and transplanted to the paralysed area. This is called facial Reanimation or dynamic reconstruction **[3]**.

Muscle transpositions are used when: (a) The facial neuromuscular system is absent. (b) Facial nerve interruption of at least 1-2 years with loss of motor endplates and (c) Crossover techniques are not possible due to donor nerve sacrifice (d) neural techniques are unsuitable. The most reliable muscle transfers presently being used include the temporalis and masseter transfers. The objective being the transfer of muscle innervated by a nerve other than the facial nerve. The goal is facial symmetry at rest and with voluntary smiling **[4]**.

Aim of the work:

Evaluation of the clinical usefulness of transposition of the temporalis muscle in treating long-standing facial paralysis through subjective and objective assessments.

Evaluation measures include:

- Subjective self-evaluation of results by the patient.
- Subjective physician grading of photographs. Preoperative and postoperative photographs were evaluated by surgeons aware of the treatment of patients with facial paralysis.
- Objective assessment of oral commissure movement and eye closure.

PATIENTS AND METHODS

The study was conducted on ten patients attending the outpatient clinic of Plastic Surgery Department at Assiut University Hospital between April, 2014 and May, 2015 with unilateral longstanding facial nerve paralysis.

In this study we used temporalis muscle transfer for correction of eye and mouth movements to improve facial symmetry at rest as well as to recreate a new smile.

Inclusion criteria:

1- Patients between 8 & 50 years.
2- Long-standing facial palsy (more than 1 year).
3- Unilateral facial palsy.

Exclusion criteria:

1- Patients <8 years or >50 years.
2- Pregnancy or lactation.
3- Patients with systemic illness as cardiac diseases, cancer or mental disorders & hepatic patients (generally debilitating diseases).
4- Patients with impaired temporalis muscle function.

Parameters used for data analysis included:

- Patient's age and sex.
- Duration of illness.
- Etiology of facial paralysis.
- Grade of paralysis (according to House-Brackmann scale).
- Temporalis muscle function.
- Lateral movement of oral commissure.
- Vertical movement of oral commissure.
- Eye movement.

Evaluation measures included:

1- *Subjective self-evaluation of results by the patient:*

The patients were asked to complete a questionnaire retrospectively to assess their satisfaction with the results. This was a questionnaire to assess improvement of their quality of life with respect to oral competence, eye closure and facial appearance.

Questionnaire given to patients postoperatively

Excellent or dramatically better	Good or moderately better	Neutral or no change	Bad or moderately worsened	Very bad or dramatically worsened
10 9	8 7	6 5 4	3 2	1 0

1- How do you feel about the appearance of your face now (as vs before surgery)?
2- How do ou feel about your ability to smile now (vs before surgery)?
3- How do you feel about your ability to close your eye now (vs before surgery)?

Fig. (1): Patient self-assessment questionnaire **[5]**.

2- *Subjective physician grading of photographs:*

Preoperative and postoperative photographs were evaluated by surgeons aware of the treatment of patients with facial paralysis. Preoperative photographs were taken for the patient in 3 positions:

- At rest position.
- During eye closure.
- During smiling.

Photographs were taken before surgery and a minimum of 2 months after surgery. Each patient was assigned a grade of I to IV (I=excellent, II=good, III=fair, and IV=poor) for improved symmetry.

3- *Objective assessment of oral commissure movement and eye closure:*

- Oral commissure movement by measuring the distance from oral commissure to ipsilateral tragus of the ear and distance from oral commissure to ipsilateral outer canthus before and after surgery to evaluate lateral and vertical movement of the commissure respectively.
- Eye closure by measuring the inter-palpebral distance before and after surgery.

The patient's smile was evaluated preoperatively according to the Rubin classification in 1974 **[6]**, which is based on the point of insertion of the zygomatic muscles to the nasolabial fold, commissure and orbicularis oris contraction vectors on the healthy side.

- Lateral movement of commissure = Preoperative distance from commissure to tragus-postoperative distance from commissure to tragus.
- Vertical movement = Preoperative distance from commissure to outer canthus-postoperative distance from commissure to outer canthus.
- Eye movement = Preoperative inter-palpebral distance-postoperative inter-palpebral distance.

RESULTS

The age of the patients ranged from 8 to 43 years old. The mean age of these patients was 23.7 years. Half of them were males. There were 7 patients suffering from left sided facial paralysis and 3 patients had right sided facial paralysis.

Of the ten treated patients, five patients were suffering from Bell's palsy, three patients had facial paralysis after tumor resection and two patients had traumatic facial paralysis. According to House-Brackmann scale, there were five patients with grade V, four patients with grade IV and one patient with grade III. Patient self-assessment results were obtained from 10 patients. Patient satisfaction was moderate to high. Patients reported mean satisfaction with facial appearance of 7.9, with smile function of 7 and with eye closure of 7.9.

The photographs were graded by 3 plastic surgeons. The most common grade was good. Three of the 10 patients were graded as excellent to good; five patients were rated as having good results and the other 2 patients were rated as fair.

Lateral oral commissure movement ranged from 2 to 7mm in the 10 patients. Mean lateral movement was 4.6mm. Vertical movement ranged from 0 to 4mm. Mean vertical movement was 2.4mm. eight patients had predominantly lateral movement with slight elevation. Two patients had predominantly vertical elevation. Eye closure movement ranged from 1 to 6mm. Mean eye movement was 3.1mm (Table 2) & (Fig. 2).

In our ten patients there was no donor site morbidity noted after the surgery.

Table (1): Results of subjective evaluation by patients.

	No. (n=10)	%
Facial appearance:		
<8	3	30.0
≥8	7	70.0
Mean ± SD (Range)	7.90±0.99 (6.0-9.0)	
Ability to smile:		
<8	6	60.0
≥8	4	40.0
Mean ± SD (Range)	7.00±1.25 (5.0-9.0)	
Eye closure:		
<8	4	40.0
≥8	6	60.0
Mean ± SD (Range)	7.80±1.55 (5.0-10.0)	

Table (2): Objective measurement of mouth and eye movements.

	No. (n=10)	%
Lateral commissure movement:		
<5mm	4	40.0
≥5mm	6	60.0
Mean ± SD (Range)	4.60±1.43 (2.0-7.0)	
Vertical movement:		
<3mm	4	40.0
≥3mm	6	60.0
Mean ± SD (Range)	2.40±1.17 (0.0-4.0)	
Eye closure:		
<3mm	3	30.0
≥3mm	7	70.0
Mean ± SD (Range)	3.10±1.37 (1.0-6.0)	

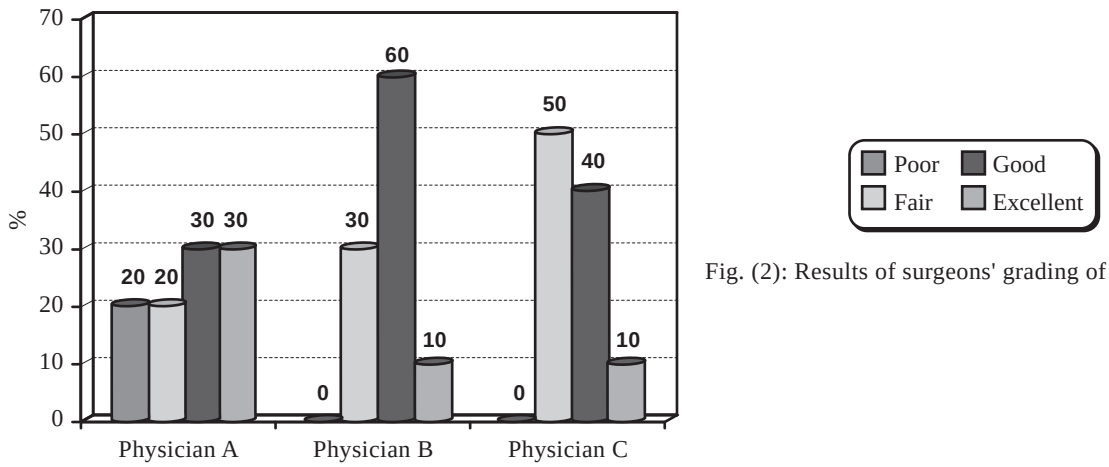

Fig. (2): Results of surgeons' grading of photographs.

Fig. (3): Female patient 8-year old with left Bell's palsy grade V.

(A&B): In repose (A) Preoperative. (B): 3 months after temproalis muscle transfer.
(C&D): During eye closure. (C): Preoperative. (D): 3 months post-operative.

Fig. (4): Male patient 13 year old with left complete facial paralysis grade IV after cholesteatoma.

(A&B): In repose (A) Preoperative. (B): 3 months after temproalis muscle transfer.
(C&D): During eye closure. (C): Preoperative. (D): 2 months post-operative.

DISCUSSION

In cases of prolonged facial paralysis, the classic nerve crossover techniques (cross-face grafts and hypoglossal-facial nerve transfer) are not viable options owing to facial muscle atrophy and motor end plate fibrosis, which prevent such procedures from having any realistic chance of success beyond a certain period. In these cases, the only techniques available to return an element of motion and symmetry to the face are free tissue transfer and redirection of adjacent innervated musculature. The temporalis muscle transfer is unique among these choices in that the effect is immediate.

In our study we had an equal distribution between males and females and regarding the age distribution, we found that facial paralysis may occur at any age. However, all cases of Bell's palsy were less than 40 years old. From the patients' self-assessment results we found that the patient's satisfaction about closure of the eye was higher than that about achieving a smile.

We found that the mean eye movement was significantly higher in patients less than 20 year old (3.25mm) compared with that in patients more than 20 year old (2.8mm) while there was no significant difference in the mean movement of the oral commissure. From these results we could say that our technique is more likely to give better results regarding eye closure in younger patients as they have more compliance towards the physiotherapy and postoperative retraining of the muscle to be able to reuse it in its new function.

In 2007, Patrick and his colleagues used orthodromic transfer of temporalis muscle insertion for

the treatment of longstanding facial paralysis in 7 patients for correction of mouth movement. In our study we used temporalis muscle transfer for correction of mouth and eye movements **[6]**.

The mean lateral movement of the oral commissure in our study was 4.6mm while Patrick and his colleagues reported a mean lateral movement of 4.2mm which is nearly consistent with our results. From these results we concluded that our use of temporalis muscle transfer in correction of eye movement did not affect its results on the oral commissure movement.

In our study we found that using temporalis muscle transfer for correction of eye closure in patients with longstanding facial paralysis is superior to other classic methods as sling procedures and gold weights which are considered static procedures and cannot achieve dynamic and voluntary closure of the eye.

Nearly all of our patients achieved complete obliteration of the lid gap on completion of physiotherapy. Apart from correcting the lid gap, it has helped to reverse the exposure keratitis experienced in most of the patients with longstanding facial paralysis.

We found that the main disadvantage of use of temporalis muscle transfer for correction of mouth and eye movements is the mass movement where the patients experienced both closure of the eye and movement of the corner of the mouth with clenching of the teeth. However, it may sometimes be beneficial for the patient to do frequent synkinetic closure of the eye to redistribute tear film and avoid dryness of the eye.

Conclusion:

Temporalis muscle transfer has become the regional muscle transfer of choice for reanimating the smile and eye closure in chronic facial paralysis. Careful perioperative planning and aggressive postoperative rehabilitation are critical to optimize results. When this is done, up to 7mm (average, 3-5mm) of commissure excursion and up to 6mm (average, 3-4mm) of eye closure can be produced.

We concluded that temporalis muscle transfer is a relatively easy procedure to perform that has distinct advantages compared with other forms of facial reanimation and provides very good results. One of the distinct advantages of temporalis muscle transfer is that it is suitable for correction of mouth and eye movements compared with free muscle transfer and orthodromic temporalis tendon transfer which can be used for mouth reanimation only. Other advantages of temporalis muscle transfer over free muscle transfer is that it is one staged procedure giving results very early postoperatively and has no or very minimal donor site morbidity.

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