



Research Article

Treatment of Prolonged Facial Paralysis With Temporalis Myoplasty and Electrical Stimulation

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Summary

Objectives: The study goal was to determine whether electrical stimulation (ES) with subthreshold, continuous, low-frequency impulses is a viable clinical method for improving functional recovery after application of temporalis muscle transfer technique operation.

Material and Methods: Eighteen patients between 15-69 years of age were selected from the patients were operated between July 2000 and July 2004. Postoperatively the patients were divided into three groups according to the electrical physiotherapy regime. As electrical stimulation we used Faradic current with 100 Hz frequency in both stimulation group as a programme, 7 min stimulation and 3 min resting total 10 min had been performed (20 min/day, 21 times days total). Aesthetic outcome (Dynamic and static evaluation), Life quality evaluation Short Form 36 (SF 36), Electromyography (EMG), photos and video records were used in the evaluation.

Results: In the visual evaluation of dynamic and static symmetry ES group had the best results which was very close to the health side. ES group had the best results in the life quality evaluation test. In the EMG analysis ES group had the closest results to the healthy facial muscles.

Conclusions: Our technique endows dynamic symmetry, educating the temporal muscle with electrical stimulation is one of the best treatment in the prolonged facial paralysis.

Key words: Prolonged Facial Paralysis, Temporal muscle transfer, Electrical Stimulation, Short form-36 (SF-36), EMG

Uzamış Fasiyal Paralizi'de Temporal Miyoplasti ve Elektrik Stimülasyon Tedavisi Özet

Amaç: Bu çalışmanın amacı, Temporalis kas transferi cerrahisi uygulama sonrasındaki; eşikaltı, sürekli, düşük frekanslı atımlı elektrik stimülasyonunun fonksiyonel geri dönüşün geliştirilmesinde uygun bir klinik yöntem olup olmadığını belirlemektir.

Gereç-Yöntem: Temmuz 2000- 2004 tarihleri arasında ameliyat edilmiş yaş aralığı 15-69 arasındaki 18 hasta seçildi. Cerrahi sonrası hastalar fizyoterapi programına göre üç gruba ayrıldı. Kullanılan elektrik stimülasyonu 100 Hz Frekansta, 7 dk stimülasyon 3 dk dinlenme toplam 10 dk (20 dk/ gün, toplam 21 seans) şeklinde uygulandı. Dinamik ve statik değerlendirme için estetik çıktı, yaşam kalite değerlendirmesi için Kısa Form SF36, Elektromiyografi (EMG), resimler ve video kayıtları kullanılmıştır.

Sonuçlar: Dinamik ve statik simetrisinin görsel değerlendirmesinde, sağlam tarafa çok yakın olan en iyi sonuçlar elektrik stimülasyon grubunda elde edildi. Yaşam Kalite değerlendirme testinde de en iyi sonuçlar elektrik stimülasyon grubunda görüldü. EMG analizinde sağlıklı yüz kaslarına en yakın sonuçlar ES grubunda kaydedildi.

Tartışma: Bizim tekniğimiz dinamik simetriyi sağlanmaktadır, uzun süreli fasiya lparalizi de temporal kasın elektrik stimülasyonu ile eğitimi en iyi tedavilerden biridir.

Anahtar Kelimeler: Uzun süreli yüz felci, temporal kas transferi, elektrik stimülasyonu, Kısa Form SF36, EMG

INTRODUCTION

The etiology of facial paralysis varies and the treatment must be chosen according to etiology (trauma, ablative operation, Bell's Palsy etc)^(3,10,20). There are two critical periods in the course of facial paralysis, in which the exact information on the pathologic state of the nerve is obtained: the first seven days and three months afterwards. For those cases with prolonged facial paralysis which have no clinical progress and clinical squeals become permanent within the first year of paralysis, should be considered as "Permanent Paralysis"^(21,23). Facial paralysis may have a significant impact on the patient's emotional status, because of facial disfigurement and difficulties with eating and drinking in a social setting. Therefore, when this devastating situation occurs, early intervention and rehabilitation is important for these patients⁽²⁸⁾.

Muscle Transfers:

Patients with prolonged paralysis, in whom the innervations of paralyzed musculature cannot be restored by nerve grafting, cross-face nerve transplantation etc⁽⁵⁾; should be offered some form of reconstructive static and dynamic aid. Latter reconstructive techniques can be named as follows: static suspensions by fascia, dermis or silastic rubbers, stabilizations by dermal flaps, bone fixation or Marlex; facial or temporal lifting, surgical formations of folds and wrinkles (forehead, furrows, nasolabial folds)^(15,24,27); control of antagonist muscles by neurectomy or myoectomy or Botox injections etc.^(6,28).

Long- Standing facial paralysis requires the introduction of viable, innervated dynamic muscle to restore facial

movement. The option include regional muscle transfer and microvascular free tissue transfer^(5,17).

In prolonged Paralysis treatment with muscle transfer dynamic techniques make it possible to regain the lost movements. In 1908, Lexer defined muscle transposition for the first time. Since then, numerous variations of muscle transfer have been reported. In 1934 Gillies had the idea of lengthening the middle third of temporalis muscle by using a strip of the fascia lata⁽¹⁷⁾. In 1949, McLaughlin described a method, using the whole muscle after sectioning the coronoid process and still using a strip of the fascia lata. Edgerton's technique utilized the anterior belly of the digastric muscle in 1967⁽⁹⁾. In 1971, Horton transplanted sternocleidomastoid muscle⁽¹³⁾. This historical progress revealed that the masseter muscle is best used to give motion to the lower half of the face and temporalis muscle transfer for the motion of upper half of the face⁽¹⁷⁾.

Electrical Stimulation

Electrical stimulation, is used as an adjunct in the management of many disorders including neuromuscular, musculoskeletal, vascular and soft tissue injuries⁽¹²⁾. Neuromuscular electrical stimulation of an area with deficits increases of contractile motions by providing proprioceptive, kinesthetic and sensory input. This modality can be used in the management of peripheral nervous system injuries such as Bell's palsy and other conditions that cause pain, weakness and immobility⁽⁷⁾.

The goals of treatment are to reeducate a muscle to gain its normal function and to facilitate motion Studies in animal models have indicated that electrical stimulation of denervated muscles retards atrophy. Somia et. al. compared the effectiveness of single

and cosmetically accepted eye blink. They established bilateral orbicularis oculi muscle paralysis in eight dog⁽²⁵⁾. Electrical stimulation has been used for gracilis muscle reeducation for reconstruction of neonatal sphincter⁽¹⁾. There is no study, electrical stimulation using in facial paralysis after muscle transfer.

From all these aspects of view, facial paralysis is a devastating disaster that turn ones face to a no mimic puppet and it should be treated by using any means of the management options. In this study, our aim was to assess the success of electrical stimulation that was administered at different stages of the course of the paralysis as a mean of co-treatment to functional muscle transfer surgery.

MATERIAL AND METHODS

Eighteen patients have been included in this study. All patients had prolonged permanent facial paralysis due to various causes and did not receive any prior treatment for this condition. The patients were operated between July of 2000 and July 2004 by, Dokuz Eylul University Medical School, Plastic Reconstructive and Aesthetic Surgery Department. The

majority of paralysis were traumatic (10/18), the other causes included; mastoidites (2/18), congenital (1/18), treatment of malign tumors (5/18). The average duration of paralysis before surgery was one year. The majority of facial paralysis years (range 15 to 69 years), and the main age was 51, all patients were taken care by the same team and operated by the same surgeon. Patients were recruited in the groups randomly.

The standard temporalis muscle transfer method was used in all patients. The muscle was split into five strips. Two strips of muscle were transposed to the eyelids and two strips to the lips and the last one strip to the nasolabial crease. (Figure 1) The study comprised of three groups according to the electrical physiotherapy regime with respect to the electric stimulation protocol they acquire (six patients in each group): The first group had only muscle transfer, without electrical stimulation. The second group had early electrical stimulation that starts on the 7th postoperative day. The third group had late electrical stimulation that started on 21st postoperative day.

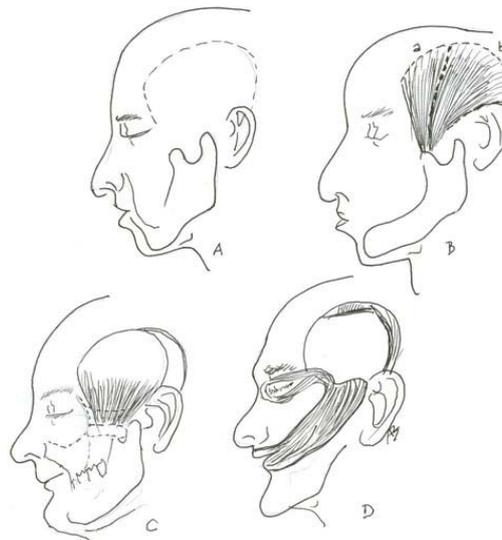


Figure 1: Technique of the operation;for all patients; Aplication of temporalis muscle transfer technique

The evaluation of results of surgical procedures of facial paralysis is very difficult. Ferreira and Faria describe this difficulty as: There is no doubt that evaluation of results is one of the most difficult problems in plastic surgery. Especially when surgical treatment deals with dynamic change in the appearance. We used three dimensional video-analysis system and pre and postoperative E.M.G.'s as objective criteria and documents^(8,11).

An electrical stimulation we used Faradic Current with 100 Hz frequency in both stimulation group as a programme, 7 minutes stimulation and 3 minutes resting totally 10 minutes Stimulation had been performed. 20 min/day x 21days for all patients in both stimulated group by physiotherapist.

Also another evaluation The Short Form 36 (SF36) was used in the functional health status. The SF-36 (Ware & Sherbourne 1992) is a generic health status measure that has been translated into various languages and is used world-wide⁽²⁹⁾. It was designed to be applied to all health conditions and to assess general health concepts, such as functional status and well-being. Each of the SF-36 and the SF-12 cover eight domains: physical functioning, role limitations due to physical health problems, bodily pain, general health, vitality, social functioning, role limitations due to emotional problems and mental health. The SF-12 was introduced as a shorter alternative to the SF-36 for use in population studies (i.e. large sample sizes)⁽²⁹⁾. Validity and reliability for Turkish society were made by Pinar et al.⁽²⁶⁾.

Photos and video records taken at the same distance and angle, were used to evaluate preoperative and postoperative status of the static symmetry. Means of gestures; whistling, smiling, shutting of the eyelids etc., were examined by the video films for the determination of the dynamic symmetry. An independent group of plastic

surgeons evaluated the photo and films to avoid bias Neurologists evaluate EMGs twice for all patients; at the end of the sixth months and at the end of the one year. The written permission was taken from the patients about their pictures to be published on the internet. Data were assessed with the program package SPSS 15.0. Paired sample test was used as a statistical method in our study.

RESULTS

Permanent facial paralysis is one of the most important aesthetic and functional handicaps. The aim in facial reconstruction is to restore the static symmetry that is an adequate appearance when the face is at rest. Dynamic symmetry should also be reconstructed, so that the patient may have satisfactory appearance during the balanced and controlled expression of emotions.

Preoperative and postoperative evaluations were made by photos and video films in same positions; symmetry in whistling, smiling, closing of eyes etc. for determination of the static symmetry. Also video records were used for determination of the dynamic symmetry. Photo and film evaluations were done by the teams of plastic surgeons different from surgical teams^(8,11).

Both electrical stimulation group patients had more satisfactory results in either static or dynamic symmetry than the group without electrical stimulation. EMG results, determined that electrical stimulation of temporalis muscles converted them very quick muscles nearly as mimic muscles.

The assessment of EMG conducted before the operation, before the electrical stimulation physiotherapy and after the physiotherapy revealed that EES group had better results compared to the LES and NES group. The LES group had better results compared to the NES. The

evaluation was done by an expert neurologist.

Another evaluation was quality of life evaluation Short Form 36 (SF 36). The short form 36 test results has shown us that EES and LES groups had better results compared to the NES($p < 0.001$). This may

be because of more improvement in facial symmetry or because patients had more interference with the doctors postoperatively. Also another evaluation Sunnybrook and House-Brackmann Facial evaluation was used^(2,14).

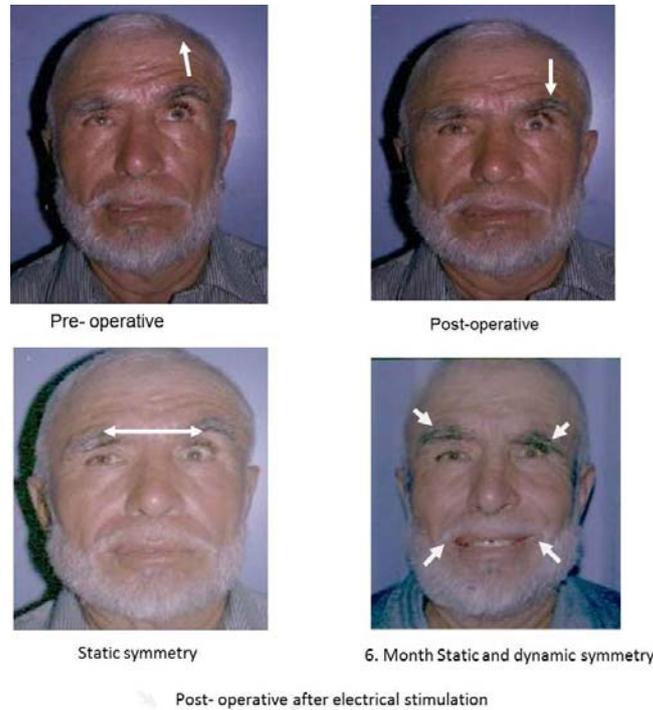


Figure 2: Pre-posttreatment photos of the patient; treated with early electrical stimulation after temporalis muscle transfer.

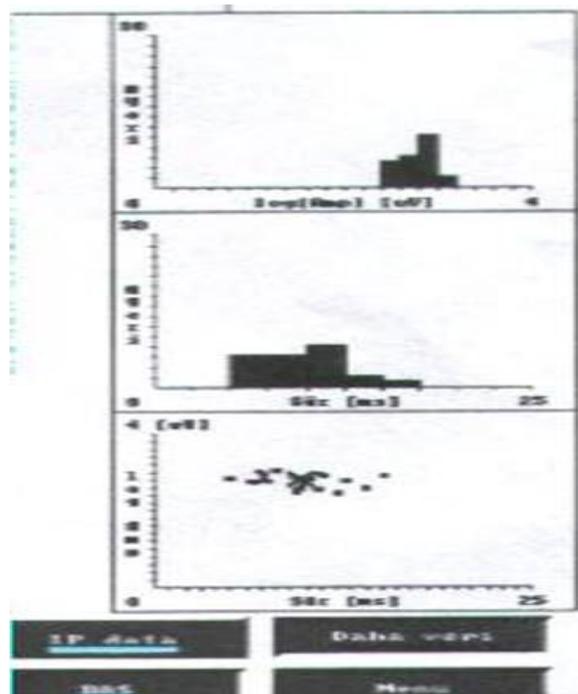


Figure 3: EMG results

DISCUSSION

Permanent facial paralysis is one of the most important aesthetic and functional handicaps⁽¹⁷⁾. The aim in facial reconstruction is to restore the static symmetry, that is an adequate appearance when the face is at rest. However, aesthetically the static symmetry is not enough, the dynamic symmetry should also be ensured to exhibit a symmetrical and balanced look in the patient's facial expressions⁽²⁸⁾. The most common facial reanimation techniques are facial nerve repair and grafting techniques, cross-face nerve grafting, hypoglossal nerve transpositions, local muscle transpositions, static suspension, and free muscle flaps⁽⁵⁾. Although facial nerve repair and grafting procedures are successful in up to 6 months, in patients who haven't been treated for 1 year, a little amount of tone, symmetry and slight movement may be achieved⁽⁵⁾.

Cross-facial nerve graft and free muscle flap are very effective methods for repairment of smile in late facial paralysis⁽²⁸⁾. However, it is practiced in selected cases for the following reasons such as for being inappropriate for all age groups, requirement of high morbidity of free flap transfer, low compliance rate, and longer duration of hospitalization⁽²⁸⁾. In the cases of complicated procedures which cannot be practiced, local muscle flaps (the temporal, masseter) still keep their current importance⁽²⁷⁾. However, due to creation of an unaesthetic depression in the mandibula angulus, and horizontal shrinkage with a rise in the edge of the mouth the masseter muscle surgery is not the main choice in repairing facial paralysis⁽¹⁷⁾. When the temporalis muscle is transferred, it does not affect the cosmetic appearance negatively (Figure 1).

The amplitude of the temporal, muscle's power and contraction rate, which is non-innervated by the facial nerve, is low. It

was realized for the first time by Galvani in 1770s that the muscle reacts against the electrical stimulus⁽¹⁸⁾. In order to increase the power of muscles and the amount of actions in the muscles, it started to be used frequently in the 1970s^(4,22). It is still in use in order to delay the atrophy of the muscles in the treatment of facial paralysis^(16,19).

Our technique endows dynamic symmetry, educating the temporal muscle with electrical stimulation, resemble mimic muscles.

As a result of satisfactory outcomes of the work, it is believed that the application of electrical stimulus has positive effects on following the muscle transfer and in the surgery of facial paralysis.

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