doi: 10.20471/acc.2025.64.01.14

# CONTEMPORARY CONCEPTS AND SURGICAL TECHNIQUES IN FACIAL REANIMATION: A SCOPING REVIEW

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SUMMARY – Paralysis of the facial nerve represents an exceptional functional, social and cosmetic problem for the patient. Loss of function directly leads to the inability to protect the eyes, as well as oral competence, while indirectly affecting breathing and verbal communication. Patients often encounter social stigmatization and isolation, which is direct consequence of the loss of mimic function and disfiguration that is necessary for everyday nonverbal communication. Thus, the quality of life is strongly impaired, and patients are prone to developing depression. The primary goal of reanimation is establishment of facial tone at rest, mimic function, and symmetry. The method of choice is directly dependent on the time elapsed from the onset of paralysis. Facial reanimation methods can be divided into static and dynamic. In reanimation procedures, we usually divide the face into thirds. Procedures for reanimation of the upper third of the face include oculoplastic procedures, which are divided according to the place of intervention into procedures aimed at the eyebrow, upper and lower eyelid. Static methods predominate here, i.e., endoscopic eyebrow lifting, tightening of the upper eyelid, and tightening of the lower eyelid. Procedures for reanimation of the lower third of the face are mainly based on restoring oral competence and smile, therefore the method of choice is dynamic reanimation. Direct repair of the nerve either by direct anastomosis or interposition provides the best results. In the absence of the proximal part of the facial nerve, and functional distal branches, local motor nerves and/or cross facial nerve graft (CFNG) are used as a source. In the case of long-term paralysis of the facial nerve (>2 years), muscle tissues are used in reanimation using local or innervated free flaps. Of the local muscle flaps, we most often use the minimally invasive temporalis tendon transfer (MIT3) method. The gracilis free flap is most often used in younger patients who desire to achieve a more accentuated smile, and the procedure can be performed in one or two acts. Reanimation of the face is an often neglected but extremely important procedure that should provide the patient with partial function resumption while significantly improving the quality of life.

Key words: *Facial reanimation; Facial nerve paralysis*

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Received September 29, 2022, accepted October 10, 2022

## Introduction

Functional, social and cosmetic disability caused by facial paralysis has an enormous impact on patient everyday life. Loss of facial nerve function has a direct impact on eye protection and lip competence causing major problems with liquid diet, while loss of facial tension influences nasal breathing and verbal communication[1]. The problems that patients with facial paralysis are facing every day are not only functional. For most of them, facial disfigurement and inability of proper social interaction remains a major problem. Facial expression is the essence of human nonverbal communication, and patients often suffer from depression and social isolation, with a profoundly negative impact on their quality of life[2]. Restoring muscle tone, movement and facial symmetry are major goals of facial reanimation. Although numerous techniques are well documented in the literature, an ideal result is almost impossible to achieve[3]. Facial paralysis can be caused by numerous conditions. The term 'facial paralysis' should be used in cases of complete inability to move the face, while in cases with an incomplete ability to move the face, 'facial paresis' should be preferred[4]. The focus of this scoping review is the management of acquired facial paralysis, highlighting iatrogenic incidents (trauma, surgery). The purpose of this paper is to provide a literature review on pretreatment assessment and most widely adopted methods of facial reanimation according to evidence-based medicine, while highlighting our experience accumulated in a tertiary referral center, which includes all of the discussed techniques.

## Material and Methods

This review was assembled following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A cross-reference PubMed and Scopus (EMBASE) search was performed and relevant data were extracted accordingly. The initial search was performed using the following key words and Boolean operators: „facial reanimation AND facial paralysis AND reconstruction". A second search was performed using the key words „facial nerve diagnostics AND reanimation".

The initial search using combinations of key words concerning facial reanimation resulted in 482 results. We applied the following search filters: Clinical Trial, Meta-Analysis, Randomized Controlled Trial, Systematic Review published in the 2011-2022 period. The search yielded 16 articles in English, with five of them representing papers reporting original data.

The second search using a combination of key words concerning facial nerve dysfunction diagnostics resulted in 73 hits. We applied the following search filters: Clinical Trial, Meta-Analysis, Randomized Controlled Trial, Systematic Review published in the 2011-2022 period. The search yielded 15 articles in English. Of these 31 articles combined from both search procedures, 12 articles contained original data and were further included in the analysis. Two authors screened the papers for eligibility, with a third author deciding on appropriateness of inclusion in this review.

## Results

After reviewing the published literature, we identified three major issues in facial reanimation: pretreatment assessment; type of injury; and time elapsed from initial injury to treatment. Based on the data available, these three issues are central in developing practical and clinically useful reanimation protocol that can accommodate individual case differences.

## Pretreatment Assessment

Various facial nerve grading systems have been proposed, i.e., the House-Brackmann grading system, the Facial Nerve Grading System 2.0, the Yanagihara grading system, the Sunnybrook facial grading system, and eFACE[1-5]. The most widely used grading system is the House-Brackmann grading system, followed by the Sunnybrook and eFACE, gaining in prominence during the study period. Although the latter two grading systems show moderate grading consistency, eFACE has a shorter testing time, higher test-retest reliability, and the ability to be used as a smartphone test. However, the Sunnybrook facial grading system is now recommended by the Sir Charles Bell Society[6,7].

Electrodiagnostics is an important tool for decision making in patients with facial nerve diseases. Electrophysiological analyses of the facial nerve and mimic muscles can assist in diagnosis, assess lesion severity, and aid in decision making. Most recent guidelines have been published by members of the International Head and Neck Scientific Group and the Multidisciplinary Salivary Gland Society. Based on the literature review, the group suggests using electromyography (EMG), electroneurography (ENoG), and the blink reflex[7]. There are two basic methods of EMG, surface (sEMG) and needle (nEMG). The sEMG measures motoneuron action potential (MUAP) in the area of surface electrode, whereas nEMG measures MUAP of the facial muscle in which the electrode is inserted. The group recommends using EMG in the time frame of 2-3 weeks up to 3 months after the onset of a facial nerve injury. EMG is a helpful monitoring tool for regeneration if reinnervation occurs. ENoG analyzes the evoked compound muscle action potential (CMAP) of a specific facial muscle after transcutaneous stimulation of the main trunk of the facial nerve. The main trunk is stimulated supra-maximally at its exit from the stylomastoid foramen. CMAP of the affected side is compared to the healthy side. ENoG should be used within the time frame of 72 h to 21 days after the onset of lesion in combination with EMG. Blink reflex uses electrostimulation of the supraorbital branch of the trigeminal nerve and simultaneous surface EMG from the orbicularis oculi muscle on both sides. Additional value when compared to ENoG and EMG is low, but can be performed if there is associated brainstem injury[8].

## Type of Injury

Type of nerve injury was first described by Seddon and Sunderland[9,10]. Seddon classified peripheral nerve injury into 3 grades on the basis of the presence of demyelination and the extent of damage to the axons and connective tissue of the nerve. Sunderland then further divided discontinuity of connective tissue in peripheral nerves. An overview of peripheral nerve injury was compiled by Hussain *et al.*, suggesting that a reanimation strategy should be planned immediately in patients with neurotmesis (Sunderland grade 5) and in some cases with axonotmesis (Sunderland grade 4), with controversial conclusions[11].

Rivas *et al.* published data on patients with an anatomically intact facial nerve following acoustic neuroma resection. In patients starting with a House Brackmann grade V or VI (facial paralysis), absent recovery after one year was the most reliable predictor of poor outcome. The resulting predictive model using the rate of functional improvement as the independent variable was found to anticipate poor outcome before 1 year in over 50% of cases with a 97% sensitivity and 97% specificity rate. Therefore, when a patient with an anatomically intact facial nerve and a House-Brackmann grade V or worse facial paralysis shows no improvement of at least one House-Brackmann grade after 6 months of observation, plans for nerve repair can be entertained[12].

## Time Interval from Initial Injury to Treatment

The issue of selecting an optimal time frame for intervention remains the most important question, but the existing literature does not provide straightforward solutions for the problem. Consensus among the authors can be found on two groups of patients, those with acute injury (up to 72 hours), and ones with paralysis lasting for more than two years.

In the case of acute nerve injury (trauma, nerve resection during surgery), an attempt should be made to reconstruct the nerve se soon as possible. The technique is dependent on the existence of proximal and distant nerve stumps.

In the groups of patients in-between acute and long-lasting paralysis, assessment of the potential for reversing facial paralysis depends on the status of facial muscles. Reversibly paralyzed facial muscles have physiologically viable fibers with intact nerve motor units that will respond to ingrowing axons. Thus, if facial muscles are completely denervated for more than one year, they will not respond properly to reinnervation. In cases of incomplete denervation, facial muscles can remain viable for longer periods of time. Therefore, facial nerve electrodiagnostics are especially valuable in patients with incomplete denervation and should be performed to determine if facial muscle paralysis can be reversed. The presence of fibrillation potentials on an EMG may suggest an electrically active muscle that could respond to reinnervation. Some authors recommend EMG testing at 6 months after the paralysis incident, and some advocate the use of EMG after 9-12 months. If there are fibrillation potentials signifying a nonfunctional nerve, but evidence of functional motor units signifying functional muscle, then a nerve transfer procedure is recommended[13,14].

In patients with paralysis lasting for more than two years, reinnervation is not an option. Numerous options for that stage are available depending on patient preferences. Static options (e.g., brow-lift, upper eyelid loading, lower eyelid suspension) are usually used for upper parts of the face, and dynamic procedures (functional muscle transfer) for the middle and lower parts of the face.

## Surgical Techniques

The main goal of treatment is restoration of symmetry in all three facial zones, i.e., upper, middle and lower face. Surgical options for treatment of facial paralysis are divided into dynamic and static procedures. Dynamic procedures are primary nerve repair, interposition nerve grafting, local motor nerves, cross facial nerve graft, regional muscle transfer, or free tissue transfer with neurovascular anastomosis. Static procedures are oculoplastic procedures and static slings (Table 1).

***Direct nerve repair and interposition grafts***

Exploration within 48-72 hours after nerve rupture allows the surgeon to use facial nerve monitoring, enabling an accurate anastomosis. If the proximal and distal parts of the nerve are present, they should be reattached using three to six epineural sutures. In this case, 10-0 nylon sutures are placed at a distance of 120 degrees, taking care to avoid tension. If the distance between the proximal and distal parts is greater than 2 cm, an interposition nerve graft should be used. Performing two anastomoses contributes to delayed results, as the regenerating axons have to traverse the graft before reaching the distal stump[15]. The most common donor sites for nerve grafting are the great auricular and sural nerves. In cases including radical parotidectomy, using an anterolateral thigh free flap for facial augmentation is possible, with nerve anastomosis to the vastus lateralis motor branch. When suturing is not technically feasible, fibrin glue is an option, protected by a temporalis muscle fascia cuff. Evidence has not shown significant differences between the use of fibrin glue or nylon sutures; however, there is a tendency to employ sutures in most cases. Nerve coaptation without sutures can be performed within the temporal bone, since preserving the bony canal of the horizontal and vertical segment of the facial nerve allows stability of the nerve graft. If the proximal stump cannot be found outside the temporal bone, intratemporal coaptation is a valuable option[16].

*Table 1. Surgical options for treatment of facial paralysis divided into dynamic and static procedures and specific for the part of the face*

| Part of the face | Dynamic procedure | Static procedure |
|---|---|---|
| Upper part | Direct nerve repair<br>Interposition nerve graft<br>CFNG<br>Local motor nerves (n. hypoglossus preferred)<br>Neurotized platysma graft | Direct brow lift<br>Lid loading<br>Lateral tarsorrhaphy<br>Lower eyelid vertical suspension with a spacer graft<br>Lower eyelid fascial sling suspension |
| Lower part | Direct nerve repair<br>Interposition nerve graft<br>CFNG<br>Local motor nerves (n. massetericus preferred)<br>Regional muscle flap (MIT3 preferred)<br>Distant muscle flap (m. gracilis preferred) | Static slings – fascia lata |

CFNG = cross-facial nerve grafting; MIT3 = temporalis tendon transfer

***Cross facial nerve graft and local motor nerves***

In the absence of a proximal nerve stump, local motor nerves (masseteric and hypoglossal nerves) are valuable motor donors for early reinnervation. Branches of the contralateral facial nerve may be recruited for cross-facial grafting, and this procedure can be executed with local motor nerve grafting. The masseteric nerve is a valuable source in patients with reversible facial paralysis. Coombs *et al.* showed that the masseteric nerve contains around 1,542 myelinated fibers compared to 834 in a buccal branch and 100 to 200 at the distal end of a cross-facial nerve graft[17]. One can reliably identify the nerve using the subzygomatic triangle, an area which is reliably found in the region 3 cm anterior to the tragus and 1 cm inferior to the zygomatic arch. Morbidity caused by nerve sacrifice is low. The anatomic position of the masseteric nerve provides the potential for tension-free anastomosis to the main trunk or peripheral branches of the facial nerve while avoiding the need of an interposition graft. Murphey compared interposition grafts to direct anastomoses, and found a delayed recovery time, 6.2 *versus* 4.1 months in favor of direct anastomosis[18]. Masseteric nerve transfers have a high probability of creating significant movement, although the resting tone is poor. The lack of resting tone is explained by the nature of the masseter muscle function, which has dense contraction with activity and little resting tone[13].

The original method of hypoglossal nerve transfer with the entire trunk of the hypoglossal nerve sacrificed and sutured to the main trunk of the facial nerve was abandoned due to significant morbidity[19]. The technique has been modified to involve partial hypoglossal nerve transfer, using histologic data; the hypoglossal nerve contains 30% more myelinated axons than the facial nerve, and partial hypoglossal nerve transfer can achieve sufficient axonal load for successful reinnervation. The technique includes the use of interposition grafts, splitting and mobilizing a segment of the hypoglossal nerve for transposition, with some authors advocating using intratemporal mobilization of the main trunk of the facial nerve for transposition. May *et al.* describe using an interposition graft to bridge a divided hypoglossal nerve (up to 40%) and the main facial nerve trunk[20]. Arai *et al.* describe splitting the hypoglossal nerve longitudinally from anterior to posterior to mobilize a split segment superiorly to the main trunk of the facial nerve[21]. Albathi *et al.* showed a faster rate of recovery for masseteric *versus* hypoglossal nerve transfers (5.6 *vs.* 10.8 months)[14]. Comparing time to first movement, masseteric transfer (in months) was significantly faster than hypoglossal transfer (4.6±2.6 *vs.* 6.3±1.3, $p<0.001$)[22].

Another option is combining nerve transfer techniques using multiple cranial nerves or cross-face nerve grafting. Owusu *et al.* describe a series of 9 patients who underwent immediate facial nerve repair following radical parotidectomy with concurrent cable grafting and masseteric to facial transposition. In their series, the motor branch to the masseteric nerve was coapted to the buccal branch of the facial nerve controlling smile, whereas a cable graft was used to repair the remaining branches[23]. Pepper describes dual nerve transfer following mastoidectomy and facial nerve decompression. With this maneuver, an adequate length of the facial nerve was obtained, and a direct end-to-side anastomosis to the hypoglossal nerve on one side, and buccal branch to masseteric nerve on the other, all through a face-lift approach[24].

When the proximal nerve stump is unavailable, the contralateral nerve can be used as a donor nerve that provides motor axons to the affected side. The contralateral facial nerve is the only donor providing spontaneous facial movement. The cross facial nerve graft (CFNG) technique relies on a contralateral facial nerve having significant redundancy in the distal buccal and zygomatic neural input due to significant arborization of nerve fibers among branches. The largest caliber mid-facial branch at the anterior border of the parotid should be selected to maximize neural input to the graft. The main disadvantage associated with this approach is the length of reinnervation (6 to 8 months) of target muscles. Unfortunately, many facial paralysis patients are referred for surgical treatment after the period of one year, causing an additional period of up to 8 months worsening muscle and distal nerve fibrosis, and potentially limiting functional outcomes. An effective solution is a two-stage babysitter approach introduced by Terzis and Konofaos, which involves joining of 40% of the ipsilateral hypoglossal nerve to the facial nerve and CFNG when the Tinel sign becomes positive, usually 8 to 15 months later[25]. Bianchi *et al.* performed a one-stage CFNG with masseteric coaptation in eight patients with the mean length of facial palsy of 10.2 months. Voluntary contraction from masseteric nerve input was seen after 2 to 4 months[26]. This approach provides earlier reinnervation, while preserving the function of native distal muscle and nerve fibers in cases of paralysis lasting longer than 6 months. Morley *et al.* combined an end-to-side nerve-to-masseter transfer with a CFNG in 27 patients. In 22 patients, spontaneous smile was observed after the surgery[27].

### *Regional and distant muscle flaps in facial reanimation*

As discussed earlier, if facial muscles are completely denervated for more than one year, they will not respond properly to reinnervation. EMG testing that shows no electric potentials enables another strategy to become an option, i.e., local or free muscle flap reanimation procedures.

Temporalis tendon transposition was initially described by Gillies who used transposition of the muscle over the zygomatic arch. Further refinements to the technique were made by McLaughlin in 1952, with an orthodromic temporalis muscle transposition and osteotomy of the coronoid process and fascial extensions. In 2000, Labbé and Huault reported a new myoplasty technique, separating the temporalis muscle from the temporal fossa and lengthening by redistribution of muscular fibers to the detriment of the posterior third[28]. Problems with this technique were the length of the scalp incision, removal of zygomatic arch, and possible injury to the neurovascular supply of the muscle. Although many further modifications to reduce the morbidity were described, Boahenne *et al.* have described a variant that gained worldwide acceptance, i.e., the minimally invasive temporalis tendon transposition (MIT3) [29]. It is performed through sufficient exposure of the anterior edge of the ascending mandibular ramus through a small melolabial incision. The periosteum is incised, and the temporalis tendon is elevated from the ascending ramus, while being attached to the coronoid process. Then, the temporalis tendon is cut as medially as possible and down to the buccinator. Osteotomy of the coronoid process is performed, and the temporalis tendon is transposed through the buccal space and attached to the orbicularis oris and zygomaticus muscle insertion in the region of the modiolus. Once the ideal tension is determined, the tendon is sutured in place. Muscle excursion can be lost when excessive traction tension is required to reach the modiolus, and in such cases, a tendon extender graft, such as fascia lata, should be considered. MIT3 is an effective and reliable method for revitalizing a dynamic face. Ideal candidates for this procedure are those who desire immediate results and are not suitable for longer or multi-step surgical procedures.

Gracilis free flap in facial reanimation was described by Harii *et al.* in 1976, and has gradually become the gold standard in facial reanimation procedure in long-lasting facial paralysis[30]. In the original technique, they describe a segment of gracilis muscle transferred to the paralyzed side of the face. One side of the muscle was sutured to orbicularis oris at the lateral commissure, and the other end under tension to the temporal fascia. Neural anastomosis was done to the deep temporal nerve. Over time, several refinements to the original technique were made, including CFNG. This is usually done as a staged procedure. The procedure is based upon robust arborization of the facial nerve, and selection of one of the buccal branches for coaptation with neural graft. When Tinel sign is positive, usually after 8 to 12 months, one can proceed to second stage, muscular transfer. Adoption of the CFNG procedure has given patients a chance for spontaneous mimetic symmetry. Another problem was the bulk of the muscle in the face, which was improved by using intraoperative stimulation and selecting only a thin part of functional muscle, based on only one fascicle to keep movement but reduce bulk. Another important refinement was the adoption of masseteric nerve anastomosis that created a one-stage reanimation procedure[31]. Some research groups have described voluntary smile, and hypothesis for this phenomenon involves neural plasticity. Although this phenomenon is seen in children, it is not believed that adults can achieve voluntary smile by masseteric nerve input only. A meta-analysis that included 1647 patients who underwent 1739 free gracilis flaps found that the rate of flap failure was 3% and that masseteric nerve coaptation led to greater improvements in smile excursion (10 mm) than CFNGs (6.8 mm)[32].

Gracilis muscle flap innervated by the masseteric nerve may also benefit from supplementary nerve input provided by a CFNG[33]. Revenaugh and Byrne published excellent results with dual innervation, in a single stage procedure, with masseteric nerve input, and CFNG input[34]. In a small series of 12 patients, Boahene *et al.* described a gracilis flap designed and transplanted as a functional double paddle muscle flap for multi-vector facial reanimation. The primary muscle paddle was fixed to the periosteum of the zygomatic arch and deep temporal fascia, while the secondary paddle was attached to the periosteum over the lateral aspect of the malar bone at the level of the lower eyelid. Distal parts of the peddles were secured to the orbicularis oris muscle, closest to the free lip margin. This resulted in statistically significant improvement in dental display, smile width, and correction of paralytic labial drape, producing periorbital-wrinkling characteristic of a Duchenne smile[35].

***Oculoplastic procedures***

Loss of eye closure, if left untreated, will lead to keratitis, ulcers, or even blindness. The most widely used techniques are lid-loading procedures, very often associated with lateral tarsorrhaphy aimed at creating fascial slings to support the lower eyelid. All these procedures are static, so the main goal is cornea protection. Dynamic procedures are better but far more complicated options. Terzis and Bruno described reanimation of orbicularis oculi with free platysma muscle transfer, but due to unreliable results, the technique was not widely used[36]. Nassif and Yung Chia describe a neurotized platysma graft as a two-stage technique. In the first stage, CFNG is performed. Second stage includes small strips of platysma muscle attached to tarsal plates, and existing fascicles are buried inside the muscle graft[37].

## Discussion

Based on the mentioned options that address results of pretreatment assessment, type of injury and time to treatment, we have proposed a functional algorithm for facial reanimation that has been modified through clinical practice in our institution. Although

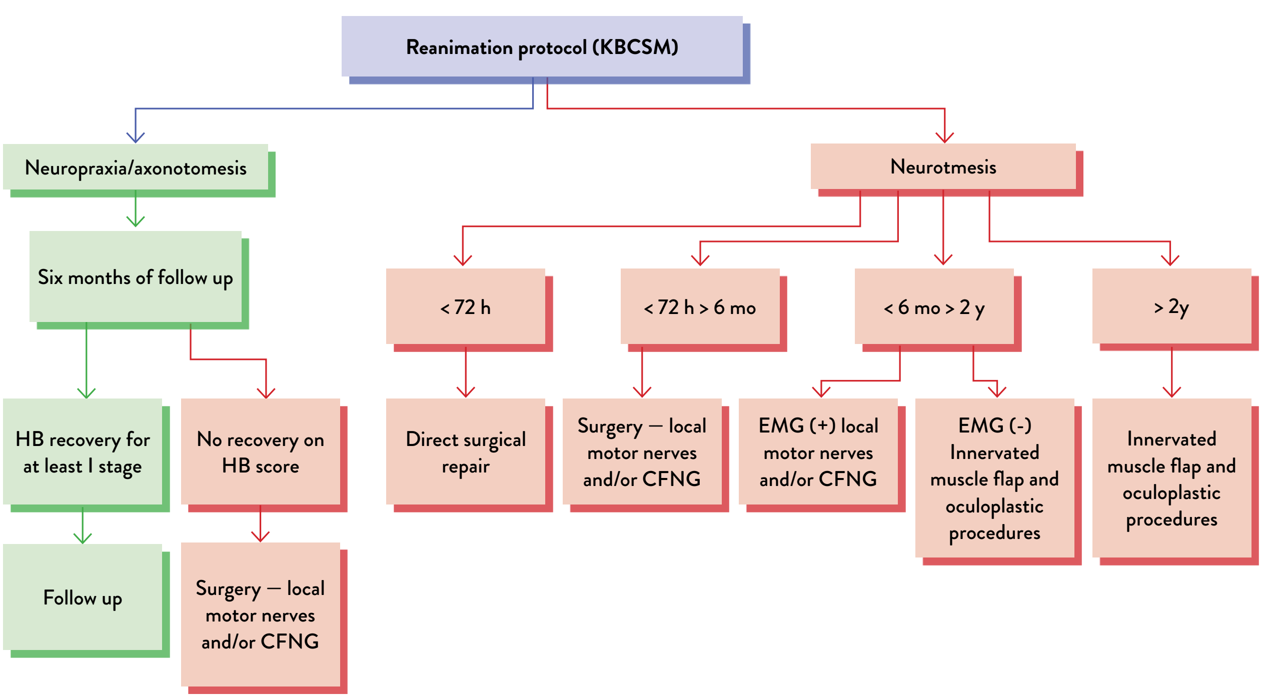


*Fig. 1. Based on pretreatment assessment, type of injury and time to treatment, we proposed a functional algorithm for facial reanimation that was modified through clinical practice in our institution.*

HB = House-Brackmann; CFNG = cross-nerve facial grafting; EMG = electromyoneurography; KBCSM = Sestre milosrdnice University Hospital Center there are numerous grading systems, House-Brackmann scale is still the gold standard for describing the degree of facial nerve injury, so it is incorporated in our algorithm. With progress in facial nerve reconstruction techniques, more precise follow up assessment systems should be created, given the need of assigning an accurate degree of function to a specific part of the face. Time between the injury and intervention remains controversial. Most authors agree on two groups, i.e., acute – up to 72 hours from the injury, and chronic – more than 2 years from the injury. Still, many patients are in-between those two periods. In our clinical practice, we divide patients with facial paralysis into four major groups according to the time elapsed from the injury: (1) up to 72 hours, (2) from 72 hours up to 6 months, (3) 6 months up to 2 years, and (4) more than 2 years. Surgical procedures according to time of the injury are summarized in Figure 1.

In cases of complete nerve injury, immediate nerve repair is paramount. Tension free anastomosis is a golden rule, and if necessary (for gaps of more than 2 cm) interposition graft is used. In cases of incomplete nerve injury, we found useful to adopt an expectative

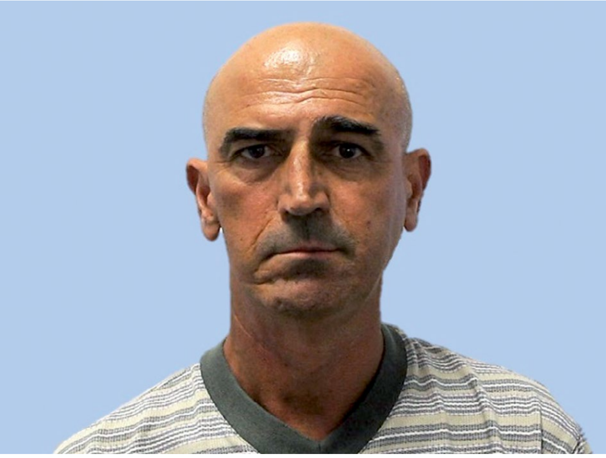

*Fig. 2. Resting tone of a 51-year-old male patient who underwent immediate facial nerve repair following right radical parotidectomy and neck dissection with dual nerve transfer. Masseteric nerve was used for end-to-end anastomosis to buccal branch, and hypoglossal nerve split was used for reanimation of other branches. Fascial anterolateral thigh free flap was used for facial contouring, giving fullness to the operated side (8 months after the surgery).*

*Fig. 3. Voluntary movement 8 months after the surgery. Great excursion of the right oral commissure and full eye closure.*

*Fig. 4. An 89-year-old female patient underwent radical parotidectomy and neck dissection with postoperative facial nerve paralysis.*

approach for 6 months. If at least some features of facial mimics do not appear in that period, facial reanimation surgery options are discussed with the patient.

In the absence of proximal nerve stump, we use direct anastomosis of masseteric nerve to the buccal facial nerve branch for smile restoration, and for facial tone we use partial hypoglossal split to the rest of the branches. If we are to use interposition grafting, the motor branch to vastus lateralis muscle is our first

*Fig. 5. Resting tone after MIT3, upper eyelid-loading procedure, and lateral tarsal strip surgery: 4 months after the surgery.*

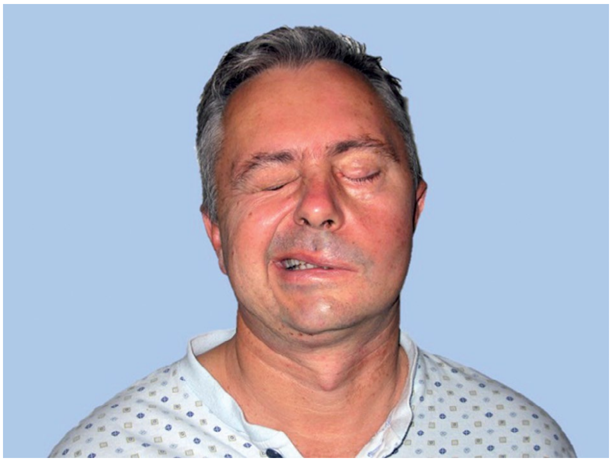

*Fig. 6. A 51-year-old male patient who suffered gunshot wound 18 years before. First procedure was done 16 years before with static fascia lata sling and upper eyelid loading. Unsatisfactory result for the patient.*

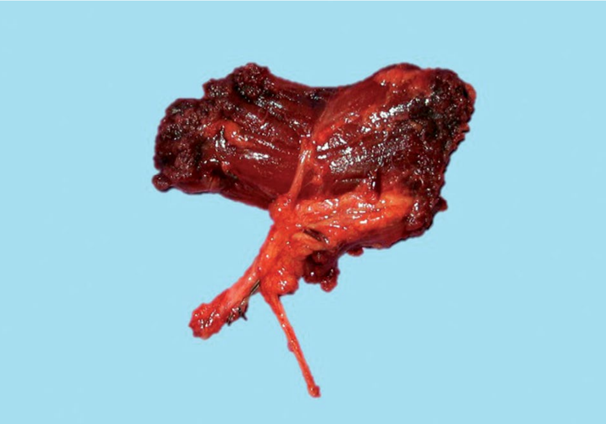

*Fig. 7. Reanimation was done using gracilis muscle free flap with dual innervation using end-to-end anastomosis to ipsilateral masseteric nerve, and end-to-side anastomosis to ensure cross-face neural facial nerve grafting.*

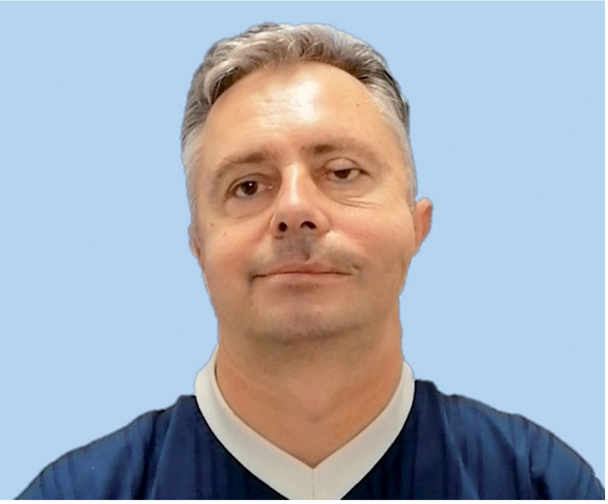

*Fig. 8. One year after the surgery: voluntary smile with good symmetry.*

choice. This method of dual innervation combines the advantages of being able to restore tone to the periocular and upper facial area due to hypoglossal input, whereas the masseteric nerve may be useful for restoration of dynamic motion to the oral commissure (Figs. 2 and 3).

In case of paralysis lasting for more than two years, muscle transfer is advised. Based on patient age, and preoperative consultation, one can discuss several options. We advise the MIT3 procedure for senior patients in combination with static oculoplastic surgery (Figs. 4 and 5). If patients desire a more natural appearance, and are capable of going through a more complicated surgery, free gracilis flap and dynamic eye procedures are performed (Figs. 6, 7 and 8).

In terms of function and aesthetics, dynamic procedures are superior to static procedures. The earliest possibility for intervention should be taken to improve functional results. All injured nerves, up to stage IV based on Seddon's classification will regenerate up to some degree, with expected aberrancy. The first six months are the most important period of nerve recovery. If no nerve recovery is observed in that time, one should plan an intervention. Better results are observed with ipsilateral reinnervation compared to transposing substitute muscles. For long-lasting paralysis, functional muscle transfer produces more movement compared to regional muscle transfer. Post treatment physical therapy is essential for success, so patient compliance should be assessed prior to treatment plan.

Balance and movement are key features of facial expression. Restoring these two key mimetic features is absolute goal of facial reanimation. Patients with facial paralysis have a great fear of permanent facial distortion. From the physician's point of view, two most important questions are; "what happened?" and "when did it happen?". Patient expectations should be respected when planning the reanimation protocol. Physicians should explain the numerous options available for reanimating the face. This gives patients hope and allows them to become active participants in their recovery. A holistic approach to facial paralysis with attention to both the paralyzed and nonparalyzed face sides yields satisfying results for everyone included in the treatment process.

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Sažetak

## PREGLED SUVREMENIH KONCEPATA I KIRURŠKIH TEHNIKA REANIMACIJE LICA

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Paraliza ličnoga živca predstavlja izniman funkcionalni, socijalni i kozmetički problem za bolesnika. Gubitak funkcije izravno dovodi do nemogućnosti zatvaranja oka, kao i oralne kompetencije, dok posredno utječe na disanje i verbalnu komunikaciju. Bolesnici se često suočavaju sa socijalnom stigmatizacijom i izolacijom, što je izravna posljedica gubitka mimične funkcije koja je neophodna za svakodnevnu neverbalnu komunikaciju. Stoga je kvaliteta života snažno narušena, a bolesnici su skloni razvoju depresije. Primarni cilj reanimacije je uspostavljanje tonusa lica u mirovanju, mimične funkcije i simetrije. Metoda izbora izravno ovisi o vremenu proteklom od početka paralize, ali i mehanizmu ozljede. Metode reanimacije lica mogu se podijeliti na statičke i dinamičke. U postupcima reanimacije obično lice dijelimo na trećine. Postupci reanimacije gornje trećine lica uključuju okuloplastične postupke koji se prema mjestu intervencije dijele na postupke usmjerene na obrvu, gornji i donji kapak. Ovdje prevladavaju statičke metode, tj. endoskopsko podizanje obrva, zatezanje gornjeg kapka i zatezanje donjeg kapka. Postupci reanimacije donje trećine lica uglavnom se temelje na vraćanju oralne kompetencije i osmijeha, stoga je metoda izbora dinamička reanimacija. Izravan popravak živca, bilo izravnom anastomozom ili interpozicijom, daje najbolje rezultate. U slučaju nedostatka proksimalnog dijela ličnoga živca i funkcionalnih distalnih grana kao izvor se koriste lokalni motorički živci i/ili kontralateralni presadak ličnoga živca. U slučaju dugotrajne paralize ličnoga živca (>2 godine) mišićno tkivo se koristi u reanimaciji korištenjem lokalnih ili inerviranih slobodnih režnjeva. Od lokalnih mišićnih režnjeva najčešće koristimo minimalno invazivnu metodu transfera tetive temporalnog mišića. Slobodni režanj vitkog mišića najčešće se koristi kod mlađih bolesnika koji žele postići naglašeniji osmijeh, a postupak se može izvesti u jednom ili dva akta. Reanimacija lica često je zanemaren, ali iznimno važan postupak koji bi bolesniku trebao osigurati djelomični povratak funkcije uz značajno poboljšanje kvalitete života.

Ključne riječi: *Reanimacija lica; Paraliza ličnoga živca*