

Facial nerve repair with neurostimulation – A methodological approach

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Abstract

The treatment modalities for the management of facial paralysis continue to evolve. We need to understand the facial nerve anatomy and the various methods for knowing the extent of facial nerve injury for successful treatment. Facial paralysis can result from blunt or penetrating trauma to the face, as well as surgical injury, either accidental or due to involvement by tumor. In addition, the etiology can be due to other causes, ranging from infectious to metabolic and is often idiopathic in nature. The aim of treatment of the injured facial nerve is to provide early recovery and to prevent corneal complications. The common treatment modalities for paralytic lagophthalmos include blephorrhaphy and tarsorrhaphy, gold weight implantation, steroid therapy and nerve stimulation. We present a case of unilateral facial

palsy following surgery of fractured condyle of mandible. Complete recovery of the facial nerve was achieved by administration of steroid and nerve stimulation therapy. During the course of treatment the eye care includes eye patching and lubrication through drops and ointments. The facial nerve emits electrical impulses which give muscles their tone and shape. On facial nerve injury the muscle does not receive these messages and thus becomes weak and floppy. External electrical stimulation mimics these electrical impulses and helps restore the muscle tone. Reanimation of the paralyzed face is an interesting and frequently evolving field.

Keywords: Facial nerve, Bell’s palsy, Transcutaneous Electric Nerve Stimulation (TENS), Methyl prednisolone.

Introduction

Unilateral peripheral facial nerve palsy may have a detectable cause (secondary facial nerve palsy) or may be idiopathic (primary) without an obvious cause (also called as Bell's palsy).^{1,2,3} Secondary facial nerve palsy is due to various causes and is generally less prevalent than Bell's palsy (1:3), first described by NA Friedreich in 1797.

The clinical symptoms in facial nerve palsy vary, depending on the location of the lesion of the facial nerve along its course to the muscles. Symptoms and signs result from the fact that the facial nerve carries motor fibers to the stapedius muscle and also supplies autonomic innervation of the lacrimal gland, submandibular gland, sensation to part of the ear, and taste to the anterior two thirds of the tongue via the chorda tympani.⁴ Thus, Bell's palsy is diagnosed upon abrupt onset of impaired facial expression due to unilateral facial weakness of all facial nerve branches, dry eyes, drooling of saliva from the mouth, the inability to close or wink the eye, to drooping of the corner of the mouth, numbness or pain around the ear, temple, mastoid, or angle of the mandible, an altered sense of taste, hypersensitivity to sounds, or decreased tearing.⁵

Case report

A 42 year old male patient reported to the Department of Oral of Maxillofacial Surgery with a chief complaint of pain in his left lower front region of the face. He had a history of a road traffic accident 2 days back. On clinical examination, there was tenderness in pre-auricular area and parasymphysis of mandible on left side, deranged occlusion, and a laceration on lower left eyelid. A provisional diagnosis of right condyle and left parasymphysis fracture was made which were confirmed by extra oral radiographs (reverse townes' view and orthopantomogram). After pre-anesthetic check-up,

patient was planned for open reduction and internal fixation for mandibular fractures, Left parasymphysis fracture was managed by reduction & fixation with 2 mm mini plates through vestibular incision and right subcondylar fracture was reduced and fixed extra orally through trans parotid approach .

Following surgery, the patient was asymptomatic of facial palsy for two days but developed weakness of right facial nerve on the third day (Fig. 1) Steroid therapy consisting of methyl-prednisolone 20 mg twice daily for two weeks was started. On 10th post-operative day on electroneurography test 70% maximal reduction was recorded as compared to normal side but complete eye closure could not be achieved. After a thorough discussion, decision was made to add nerve stimulation as an adjunct to the steroid treatment. Medical and physical therapy by TENS (Trans - cutaneous Electric Nerve Stimulation, Fig. 4) with 100 contractions/ session with 3-4 sessions /week until recovery, was started (Fig. 2). Also muscle stimulator therapy and facial muscle exercises were executed. We observed a marked improvement after few sessions of therapy, and functional activity of the facial nerve was completely regained after 4 weeks (Fig. 3).

Discussion

To clinically assess the severity of peripheral facial nerve palsy various scoring systems are available. The most widely accepted scoring system is the House–Brackmann facial nerve grading system (HBS). The degree of facial nerve palsy can also be assessed by means of the Yanagihara grading system,⁶ the Sunnybrook scales, the Jadad score of methodological quality, scales on computer systems, and various other systems.⁷ Most grading systems rely on the evaluation of resting symmetry, degree of voluntary excursion of the facial muscles, and the degree of synkinesis (involuntary movement

accompanying a voluntary movement) triggered by specific voluntary movements.⁸

Maximal Stimulation Test (MST) and Electroneurography (ENoG) are the most reliable methods in predicting the prognosis if done 7-10 days after onset of facial paralysis. Facial nerve velocity may be done when side to side comparison is not possible as in bilateral facial palsy. The blink reflex is used to rule out lesion at the pons or medulla. Electromyography (EMG) of the muscles determines signs of denervations and/ or re-innervation as well as the degree of recruitment of motor units. If EMG result show signs of re-innervation, the biofeedback training would be of help in functional restoration.⁹ If EMG reveal signs of complete denervation within the first 2 weeks of paralysis, it suggest the need for early facial nerve decompression.^{10,11} In long standing denervations, without signs for reinnervation, EMG might help in evaluating the facial muscle status i.e. whether there is complete muscle fibrosis or there are still viable contractile muscle fibers. This helps in determining the future line of physical or surgical treatment.

Treatment with electrical stimulation should depend on pathology of facial nerve. If there is no electrophysical sign of muscle denervation, Faradic stimulation or electrical stimulation of 0.1-1 ms pulse should be delivered at a frequency of 1-2 pulses for 50-200 contractions per session with 3 sessions per week until recovery.^{12,13}

If there is electrophysical sign for complete facial nerve degeneration, interrupted galvanic stimulation (IGS) of 100 ms rectangular pulses may be given at a rate of 1 pulse for 30-100 contractions per sessions.¹³ When IGS is used, it is usually given 3 sessions per week possibly for no more than 4 months. The IGS should not be used once contracture or synkinesis appears. Also, it should be discontinued once voluntary facial movement is regained

(even partially). Henceforth, active exercises for the facial muscles should be practiced to enhance functional recovery.

Biofeedback training for the facial muscles in front of a mirror was reported to prevent synkinesis after facial palsy.¹⁴ EMG biofeedback training can also be used to improve functional recovery and facial symmetry in patients with electromyographic evidence of facial muscle reinnervation. Besides, facial retraining and EMG biofeedback retraining were successful in treating patients with synkinesis.^{15,16} In presence of facial contracture ultrasound therapy (3 MHz, for 5 min/session, 5 sessions/week for 3-6 weeks) may be given, These therapeutic modalities were suggested for treatment contracture as they are known to loosen fibrous tissue adhesions.¹⁷

Conclusion

Physical therapy for patients with facial paralysis traditionally consisted of generic facial exercises or electrical stimulation. Though there are no conclusive studies to support or deny the role of electro stimulation and physiotherapy in the management of facial nerve palsy, early management with corticosteroids, electrical stimulation and facial muscle exercises have shown to improve the early recovery of facial nerve functions.

References

1. Kawiak W, Dudkowska A, Adach B. Diagnostic difficulties in etiology of the lesion of peripheral neuron of the facial nerve during the growth of sialoma. *Ann Univ Mariae Curie Sklodowska* 1994;48:125-128.
2. Peitersen E. Bell's palsy: the spontaneous course of 2,500 peripheral facial nerve palsies of different etiologies. *Acta Otolaryngol Suppl* 2002;549:4-30

3. Shaw M, Nazir F, Bone I. Bell's palsy: a study of the treatment advice given by neurologists. *J Neurol Neurosurg Psychiatry* 2005;76:293–294.
4. Atzema C, Goldman RD. Should we use steroids to treat children with Bell's palsy? *Canadian Family Physician* 2006;52:313–314
5. Ahmed A. When is facial paralysis Bell palsy? Current diagnosis and treatment. *Cleve Clin J Med* 2005;72:398–401.
6. Satoh Y, Kanzaki J, Yoshihara S. A comparison and conversion table of 'the House-Brackmann facial nerve grading system' and 'the Yanagihara grading system'. *Auris Nasus Larynx* 2000;27:207–212.
7. Ahrens A, Skarada D, Wallace M, Cheung JY, Neely JG. Rapid simultaneous comparison system for subjective grading scales grading scales for facial paralysis. *Am J Otol* 1999;20:667–671.
8. Ross BG, Fradet G, Nedzelski JM. Development of a sensitive clinical facial grading system. *Otolaryngol Head Neck Surg* 1996;114:380–386.
9. Shafshak TS. Electro diagnosis in facial palsy. In:Akyuz G editor *Proceedings of the 5th Mediterranean Congress of Physical and Rehabilitation Medicine, Antalya(Turkey),September 30th – October 4th,2004.Bologna(Italy) :Medomond; 2004.p.459-87.*
10. Gantz BJ, Rubinstein JT, Gidley P, Woodworth GG. Surgical management of Bell's palsy . *Laryngoscope* 1999;109:1177-88.
11. Sinha PK, Keith RW, Pensak ML. Predictability of recovery from Bell's palsy using evoked electromyography .*Am J Otol* 1994;15:769-71.
12. Diels HJ .Facial paralysis: is there a role for a therapist? *Facial Plast Surg* 2000;16:361-4.
13. Mosforth J. Taverner D. Physiotherapy for Bell's palsy . *Br Med J* 1958;2:675-7.
14. Nakamura k' Toda N' Sakamaki K' Kashima K' Takeda N. Biofeedback rehabilitation for prevention of synkinesis after Facial palsy. *Otolaryngol Head Neck Surg* 2003;128:539-43.
15. Gronin GW' Steenerson RI. The effectiveness of neuromuscular facial retraining combined with electromyography in facial paralysis rehabilitation. *Otolaryngol Head Neck Surg* 2003;128:534-8.
16. Beurskens CH' Heymans PG. Positive effects of mime therapy on sequelae of facial paralysis: stiffness' Lip mobility ' and social and physical aspects of facial disability . *OtolNeurol* 2003;24:677-81.
17. Weber DC Brown AW. Physical agent modalities. In Braddom RL editor. *Physical Medicine and Rehabilition. 2nd ed. Philadelphia WB Saunders Company; 2000.p. 440-58.*



Fig. 1: Patient with right side facial nerve palsy



Fig. 2: Transcutaneous electronic nerve stimulation (TENS) therapy



Fig. 4 TENS therapy equipment



Fig. 3 Complete recovery of facial nerve