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Effects of EMG Biofeedback Training on Facial Muscle Strength and Motor Nerve Latency in Bell's Palsy

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Abstract: ***Background: Unilateral paralysis of the facial muscles and synkinesis is the cause of bell's palsy. The conversion of myoelectric signals in the muscle into visual and auditory signals is created by new feedback systems by using EMG biofeedback technique of retraining muscle. Aim and objectives: To find out the effects of EMG biofeedback training on facial muscle strength and motor nerve latency in bell's palsy. Methodology: 12 participants were selected according to inclusion and exclusion criteria and consent was taken. 3 muscles selected, for each muscle 120 contractions were given in 3 sets i.e. 40 contractions in each set. Evaluation was done for facial muscle strength with the help of house brackmann scale and motor nerve latency with the help of nerve conduction unit. Treatment was given for 2 weeks with included 3 sessions per week. And post treatment house brackmann score and latency was found. Results: The difference in house brackmann scale was 0.667 (p-0.0015). The difference in latency of frontalis was 0.124 (p- 0.0149), orbicularis oculi was 0.108(p- 0.0299) and orbicularis oris was 0.1382(p- 0.0552). Conclusion: In this study we concluded that there is effect of EMG biofeedback training on facial muscle strength and motor nerve latency in bell's palsy.***

Keywords: Facial muscle strength, motor nerve latency, Bell's palsy, House brackmann scale, Electromyography biofeedback

1. Introduction

Unilateral paralysis of the facial muscles and synkinesis is the cause of bell's palsy. Total recovery of the function of facial muscles can be jeopardized by using exercise or electric stimulation in an inadequate way which is caused because of persistence of synkinesis.(2)

Facialnerve can lose function overnight without any unknown cause characterized by total paralysis of the muscles of the facial expression on that side. The muscles of the affected side become sag and the normal lines around the lips, nose and forehead become depressed. When the patients attempt to smile, the corner of the mouth on the paralyzed side does not move and saliva may gush from between the lips of paralyzed side.(5)

To facilitate normal movement patterns after injury, biofeedback is used from more than 50 years as rehabilitation. It is a technique of providing biological information to patients in real time that would otherwise be unknown. Two strategies are being used in biofeedback: 1. Direct feedback regarding the measured variable and 2. Transformed feedback regarding measured variable, where measurements are used to control an adaptive auditory signal, visual display or tactile feedback method.(21)

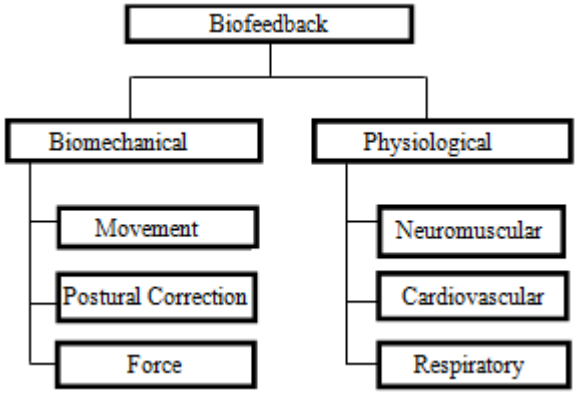


Figure 1: Categories of biofeedback used in physical rehabilitation.

The conversion of myoelectric signals in the muscle into visual and auditory signals is created by new feedback systems by using EMG biofeedback technique of retraining muscle. To detect change in skeletal muscles, surface electrodes are used which is then fed back to the user usually by a visual or auditory signals. It can be used to either increase activity in weak or paretic muscle or it can be used to facilitate a reduction in tone.(13)

EMG biofeedback resulted in greater improvements in functional properties such as muscle force, active range of motion and motor recovery in hemiplegic patients.

Electromyography is the measurement of the electrical signals associated with muscle activity. The response of the fibres comprising a motor unit when they contract in response to an action potential is an electrical disturbance called the motor unit action potential (MUAP). During a normal muscle contraction many hundreds of motor units

fire asynchronously, producing electrical potentials which can be detected either by needle electrodes in the muscle tissue or by surface electrode.[13]

Nerve conduction velocity test involves impulse to initiate directly in motor and sensory nerves. By recording the evoked potential the conduction time can be either from the muscle innervated by the sensory nerve or from the motor nerve itself Peripheral nerve is superficial enough to be stimulated through the skin at two different points by NCV test. The most commonly tested motor nerves are the ulnar, median, radial, sural, and superficial fibular nerves.[13]

2. Method

The method of this was an experimental study. 20 samples were collected according to inclusion and exclusion criteria from recognised hospitals in and around pune. Target population was Bell's palsy patients and the patients who had been diagnosed as bell's palsy before 1 month. Convenient sample was the sampling method. The study included patients of any age group and both the gender.

Inclusion criteria-
1) Individual with all age groups and both gender.
2) Patients diagnosed with bell's palsy between 1-2 months.
3) Co-operative patients.

Exclusion criteria
1) Bilateral facial weakness due to demyelinating neuropathy.
2) UMN facial palsy.
3) Patients with metal implants.
4) Patients with sensory impairments.
5) Ulcers, infections, tumour, etc.
6) Patients with ENT impairments or any facial surgery.

Outcome measure-
1) House Brackmann Facial Nerve Grading Scale
2) Latency period

Materials which were used in the study were the demographic sheet, consent form, EMG and NCV unit.

Out of 20 samples, 3 patients rejected for the treatment, 5 patients discontinued the treatment and remaining 12 patients completed the treatment. Method of the treatment was explained to the patient and consent was taken. Evaluation of the patient was done using the House Brackmann Facial Nerve Grading System and Motor Nerve Latency.

There was one ground electrode, active electrode, inactive electrode and stimulating electrode. Active electrode was placed on the muscle which is to be tested, inactive electrode was placed on nose and stimulating electrode was placed behind the ear.

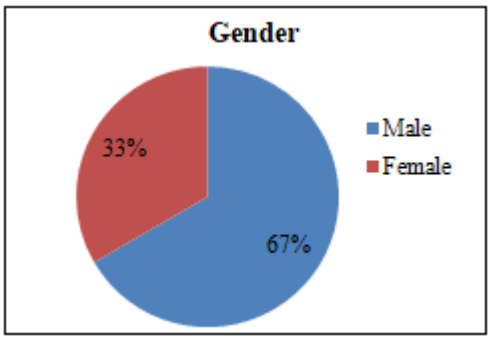
3 muscles selected were frontalis, orbicularis oculi and orbicularis oris. The patient was asked to contract the muscle 120 times in 3 sets i.e 40 contractions in each set. The treatment was given for 2 weeks which included 3 sessions per week.

After the treatment was completed, the patients were assessed again with the help of house brackmann facial nerve grading system and post treatment latency was found.

3. Results

Table 1: Graphical representation for the total number of males and females

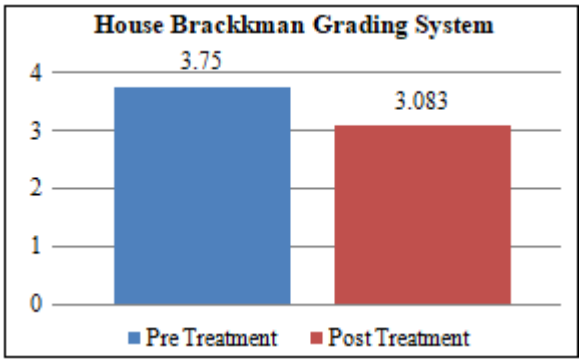
Category	*Males*	*Females*
Number of patients	8	4



Interpretation: Out of 12 patients, 8 that is 67% are males and 4 that is 33% are females.

Table 2: Graphical representation for House Brackkman Facial Nerve Grading system

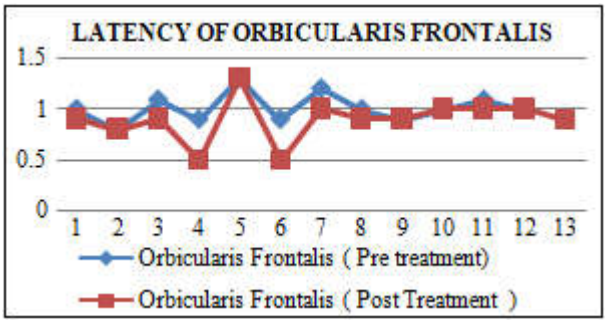
Category	*Pre treatment*	*Post treatment*
Mean	3.75	3.083



Interpretation: Mean of pre-treatment House Brackmann Scale is 3.75 whereas post treatment is 3.083. P value is 0.0015.

Table 3: Graphical representation for Latency of Orbicularis Frontalis Pre and Post treatment

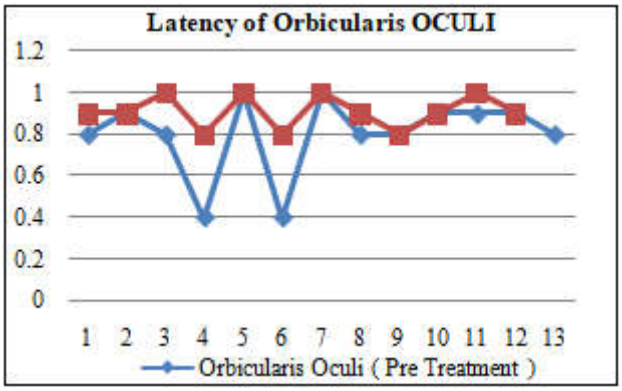
	Pre treatment	*Post treatment*
Mean	0.891	1.015
Standard deviation	± 0.2193	± 0.1393
p value	0.0149	



Interpretation: Latency of orbicularis frontalis pre and post treatment for 7 patients improved whereas for 5 patients remained the same.

Table 4: Graphical representation for Latency of Orbicularis Oculi pre and post treatment.

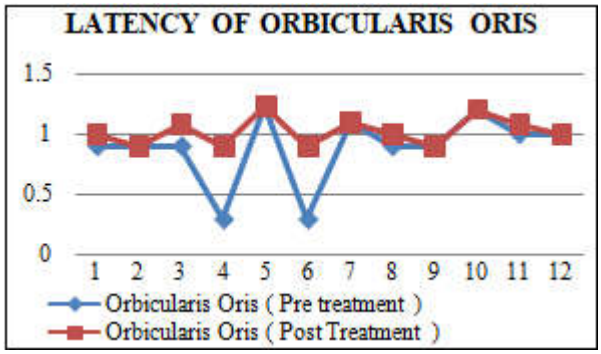
	Pre treatment	*Post treatment*
Mean	0.8	0.908
Standard Deviation	± 0.2000	± 0.0793
p value	0.0299	



Interpretation: Latency of orbicularis oculi pre and post treatment for 7 patients improved whereas for 5 patients remained the same.

Table 5: Graphical representation for Latency of Orbicularis Oris pre and post treatment

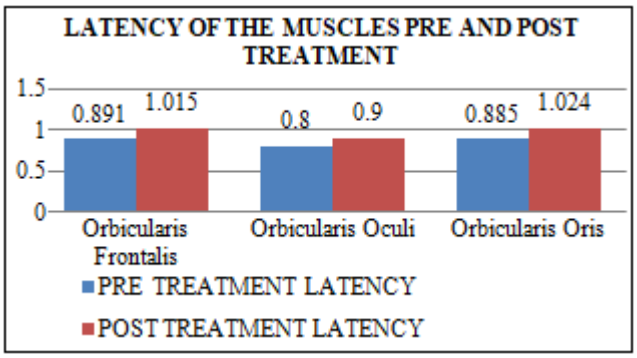
	Pre treatment	*Post treatment*
Mean	0.8858	1.024
Standard Deviation	± 0.2979	± 0.1163
p value	0.0552	



Interpretation:: Latency of orbicularis oris pre and post treatment for 7 patients improved whereas for 5 patients remained the same.

Table 6: Graphical representation for mean value of the latency of the muscles pre and post treatment

Muscles	*Mean (Pre-treatment)*	*Mean (Post treatment)*
Orbicularis Frontalis	0.891	1.015
Orbicularis Oculi	0.8	0.9
Orbicularis Oris	0.885	1.024



Interpretation: The difference between the latency of pre and post latency of orbicularis frontalis is 0.124. The difference between the latency of pre and post treatment of orbicularis oculi is 0.1. The difference between the latency of pre and post treatment of orbicularis oris is 0.139.

4. Discussion

The project is about the effectiveness of EMG biofeedback training in bell's palsy. Bell's Palsy can cause unilateral paralysis of the facial muscles and synkinesis. Bell's palsy is the most frequent cranial mononeuropathy with an annual incidence of 10 to 40 cases per 100,000 populations with geographical variation. It can appear at any age, but mostly in the third and fourth decade of life.

Bell's palsy takes place suddenly and it takes a few days or even several months. It will due to some syndromes, infections, traumas or tumors. Patient may Sufferfrom different range of symptoms in different severity from mild weakness to total paralysis. Disability in affected side is occurred with dysfunction of laughing, whistling, opening wing of noise, closing eye, scowling, elevating eyebrows and also it may be associated with drooling, excessive tearing existing pain around the jaw, dizziness, hypersensitivity to sound on the affected side, dryness of eye or mouth, impairment in eating and speaking and sometimes decrease in sense.

The sample size for this project that I collected was 12. Out of which 8 were males and 4 were female. Patients were selected according to inclusion and exclusion criteria. All the patients were in their acute phase of bell's palsy. The patient included of different age groups. Aims and objectives were discussed with the patient and consent form was filled. Demographic data sheet was also filled which included name, age, gender, occupation, when was bell's palsy diagnosed.

House Brackmann Facial Nerve Grading System was used for the assessment of bell's palsy. With the help of Nerve Conduction study, latency for 3 muscles that are orbicularis

frontalis, orbicularis oculi and orbicularis oris was done. Treatment was given for 2 weeks which included 3 sessions in first week and 3 sessions in second week. The patients were asked to contract muscles 120 times with 40 contractions in each set via Auditory EMG which was used as a biofeedback.

House Brackkman Facial nerve grading system includes grades from I to VI, in which I indicates normal facial function in all areas whereas VI indicates total paralysis or no movement. Most of the patients were in grade IV which indicated moderately severe dysfunction. Grade IV tells us that there is obvious weakness and disfiguring asymmetry, at rest, normal symmetry and tone, whereas there is no motion in forehead, incomplete closure of eyes and mouth shows asymmetric with maximum effort.

Out of 12 patients, 1 patient was grade 2, 3 patients were in grade 3, 6 patients were in grade 4 and 2 patients were in grade 5 pre treatment. Whereas post treatment, 3 patients were in grade 2, 5 patients were in grade 3 and 4 patients were in grade 4. 1 was diagnosed before ½ month, 3 patients were diagnosed before 1 month, 2 were diagnosed before 1 and half month, 4 were diagnosed before 2 months, 1 was diagnosed before 2 and half month and 1 was diagnosed before 3 months.

According to the article published in March 2003 named ' The use of Nerve Conduction Studies in determining the short term outcome of bell's palsy" by K M Prakash, MRCP, A A Raymond and FRCP; they concluded that there was a strong positive correlation between facial nerve degeneration and the clinical outcome of bell's palsy at one month ($r= 0.794$, p value= <0.0005) and at 2 months ($r=0.732$, $p <0.0005$).

Pre-treatment and Post treatment House Brackkman Score was entered into the excel sheet. The mean was removed differently for both pre-treatment and post treatment house brackkman facial grading system. The same data was entered into the InStat and we obtained the P value, standard deviation, KS test, etc.

According to the article published in 2008 named Effects of Exercises on Bell's Palsy: Systemic Review of Randomized Controlled Trials, mirror exercises with combination of EMG biofeedback was given and there was improvement noted with respect to symmetry of voluntary movement and linear measurement of facial expression.

The patients were given auditory EMG biofeedback and it was found that there was improvement in more than 50% patients whereas there was no difference seen in remaining patients. The latencies were entered into the excel sheet and line graph was made with the help of the values.

The p value for house brackmann facial nerve grading system is 0.0015 which is considered very significant with $t = 3.603$. The p value of frontalis muscle is 0.0149 which is considered significant with $t = 2.882$. The p value for orbicularis oculi is 0.0299 which is considered significant with $t= 2.493$. The p value for orbicularis oris is 0.052 with $t = 2.145$.

5. Conclusion

The study concluded that the result is clinically significant but not statistically significant. There was difference seen facial muscle strength as well as the motor nerve latency for 2 muscles that are frontalis and orbicularis oculi and no difference seen in orbicularis oris.

6. Future Scope

1) Study can be done in large number of population.
2) Patients with upper motor neuron palsy can be included.
3) Study can be done for longer duration.

References

[1] Maria Grosheva, MD; Claus Wittekindt, et al:Prognostic Value of Electroneurography and Electromyography in Facial Palsy: (Laryngoscope 118: March 2008).
[2] Jefferson Rosa Cardoso, Elsie Cobra Teixeire, et al:Effects of Exercises on Bell's Palsy: Systemic Review of Randomized Controlled Trials: (Otology and Neurology 29:557-560 © 2008).
[3] NavidMirzakhani, Leila AngootiOshnari, et al:The Comparison Between Exercise Therapy and Biofeedback Therapy in facial Function and Quality of Life of Bell's Palsy (Journal of Clinical Physiotherapy Research 2017;2(3): 139-143).
[4] GordanaDjordjevic, StojankaDjuric: Early Prognostic Value of Electrophysiological Tests in Bell's Palsy-Estimating The Duration Of Clinical Recovery(Medicine and Biology Vol 12, No 1, 2005, pp 47-54).
[5] Tharani G, Rajalaxmi V, et al:Comparison of PNF Versus Conventional Exercises For Facial Symmetry And Facial Function In Bell's Palsy (International Journal Of Current Advanced Research ISSN:O: 2319-6479, Volume 7; Issue (I); January 2018; Page No. 9347-9350).
[6] MistryGopi S, ShethMegha S, et al:Comparison Of The Effect Of Mime Therapy Versus Conventional therapy On The Sunnybrook Facial Grading System In The Patients With Acute Bell's Palsy(International journal Of medical research And Health Sciences, 2014;3(1):133-136, ISSN: 2319-5886).
[7] Lais Garcia CapelWenceslau, et al:Peripheral Facial Paralysis: Muscle activity in different onset times(CoDAS 2016; 28 (1):3-9).
[8] Maurizio Barbara, Giovanni Antonini, et al:Role of Kabat physical rehabilitation in bell's palsy: a randomized trial(ActaOto- laryngological, ISSN 0001-6489, 2010; 130: 167-172).
[9] T. Castrofloria, D. Farina, et al: Surface EMG of jaw elevator muscles: effect of electrode location and inter-electrode distance (Journal of Oral Rehabilitation 2005; 32; 411-417)
[10] FahreddinSadikoglu, CemelKavalcioglu et al: Electromyographic (EMG) signal detection, classification of EMG signals and diagnosis of neuropathy muscle disease: (Procedia Computer Science 120 (2017) 422-429).
[11] LazaroTeixeire, Juliana S Valbuza et al: Physical therapy for Bell's palsy (idiopathic facial paralysis) (

Cochrane Systemic Review- Intervention 2011 Dec 7; (12): CD006283. Doi: 10.1002/14651858.CD006283. pub3).
[12] K M Prakash, MRCP, et al: The use of nerve conduction studies in determining the short term outcome of bell's palsy: (Med J Malaysia Vol 58 No. 1 March 2003).
[13] Susan B. O'Sullivan, Thomas J. Schmits, George d. Fulk: Physical Rehabilitation (6th edition © 2014 by F. A. Davis Company).
[14] Quinn R, Cramp F: The efficacy of electrotherapy for bell's palsy: The systemic review(PhysTher Rev 2003;8:151-64).
[15] Basmajian JV: Research foundations of EMG biofeedback in rehabilitation(Biofeedback Self-Regul 1988;113:275-98).
[16] Nakamura K, Toda N, Sakamari K, Kasimha K, Takeda N: Biofeedback rehabilitation for prevention of synkinesis after facial palsy(Otolaryngol Head Neck Srug 2003;128:539-43).
[17] Ross B, Nedzelski JM, McLean A: Efficacy of feedback training in long standing facial nerve paresis(Laryngoscope 1991;101:744-50).
[18] May M, Blumenthal F, Klain SR: Acute bell's palsy: prognostic value of evoked electromyography, maximal stimulation, and other electrical tests (Am J Otol. 1983;5: 1-7).
[19] Danielids V, Skevas A, Van Cauwenberge P, Vinck B: A comparative study of age and degree of facial nerve recovery in patients with Bell's palsy (European Archives of Oto-Rhino-Laryngology 1992; 256:520-22).
[20] House JW, Brackmann DE: Facial nerve grading system (Otolaryngol Head Neck Surg. 1985; 93: 146-147).
[21] Oonagh M Giggins, ulrik McCarthy Persson, et al: Biofeedback in rehabilitation(Journal of NeuroEngineering and rehabilitation 2013, 10:60).