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Effect of Electrical Stimulation and Active Muscle Contractions in Bell's Palsy

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Abstract: ***Introduction: Bell's palsy is a temporary paralysis that causes facial weakness of one side of face. Bell's palsy occurs when the nerve that controls the facial muscles is swollen, inflamed, or compressed, resulting in facial weakness or paralysis. Objectives: -To find out effectiveness of active muscle contraction in bell's palsy. To find effectiveness of electrical stimulation in bell's palsy. To compare effectiveness of active muscle contraction and electrical stimulation in bell's palsy. Methods: - 30 subjects of early diagnosis, having Bell's palsy were recruited. They were allocated into 2 groups and treated with electrical stimulation, active muscle contraction. 30contractions were given to each muscle in 3 sessions and 10 contractions were given to each facial nerve trunk. The intensity was increased until minimal visible contractions of the muscle are obtained. Post treatment progression was made after 5 weeks of intervention. The objective outcome measures House- Brackmann Scale (HBS) and Manual muscle testing (MMT) were used to assess the facial symmetry pre- treatment and at the end of 5 week. Result: Both the groups showed improvement but there was significant improvement on HBS Scale in group treated with electrical stimulation and active muscle contractions are effective in management of Bell's palsy.***

Keywords: House- Brackmann scale, Manual Muscle Testing, Electrical stimulation, Active Muscle Contraction, Bell palsy

1. Introduction

Bell's palsy, also termidiopathic facial paralysis, is most common cause of unilateral facial paralysis. It is one of the most common neurologic disorders of the cranial nerves. Bell's palsy is usually a type of temporary sudden paralysis that causes weakness of the muscles of the face on one side. Rarely can it affect both sides [1]

Bell's palsy is named after Sir Charles Bell, who has long been considered to be the first to describe idiopathic facial paralysis in early 19thcentury [2]

The incidence of Bell's palsy in the United States is approximately 23 cases per 100,000 persons. The condition affects approximately one person out of 65 in a lifetime [3]

Symptoms vary from persons to person like absences of wrinkles, frowning, and difficulty in chewing, difficulty in smiling. Various treatment options are available like facial exercise, massage, electrical stimulation, medicine. In some cases surgical decompression may also considered.

External electrical stimulation can try and mimic these electrical impulses and help restore muscle tone [4]. In Active muscle contraction, Voluntary contraction produce a stronger contraction than electrical stimulation so that, we asked to do simultaneous action of muscle with electrical stimulation.

2. Review of Literature

- Robert S. Targan, Gad Alon, and Scott L. Kay, Montgomery Village and Baltimore, Maryland, and Princeton, New Jersey conducted study on Effect of long – term electrical stimulation on motor recovery and improvement of clinical residuals in patients with unresolved facial nerve palsy. In this study motor nerve conduction latencies. House – Brackmann facial recovery scores use and patient were treated at home for periods of up to 6 hours daily for 6 month with a stimulator. This study may prove beneficial to patient with choric facial nerve paresis.
- Alakram P and Puckree T. Conducted study on Effect of Stimulation in Early Bell's Palsy on Facial Disability Index Score. In this study two group involved experimental group received electrical stimulation and heat therapy, massage and exercise and the control group also received heat therapy, massage, exercise. FDI of the control group improve 17, 8% and 95, 4% with a mean of 52, 8% and experimental group ranged between 14, 8% and 126% with a mean of 49, 8%. Electrical stimulation during acute stage of Bell's palsy showed improvement in FDI rate of recovery similar to that of House- Brackmann scores.
- Barbara M, Antonini G, Vestri A, Volpini L, Monini S, Anta otolaryngology 2010, conducted study on Role of Kabat physical rehabilitation in Bell's palsy: a randomized trial. Randomized study involved 20 patients affected by Bell's palsy. In this study clearly shownimprovement in patient whose treated with Kabat rehabilitation comparison with non-rehabilitated patients.
- Patrica J Ohtake, Michelle L Zafron, Laksmi G poranki, study on Does electrical stimulation improve motor recovery in patients with idiopathic facial (Bell's) palsy. This article is not case report. The examination, evaluation, and intervention sections are purposely abbreviated.

3. Material and Methodology

30 Subjects with Bell's palsy willing to take treatment for 5 week were recruited for study. The subjects were screened and were put in either of the group A (Electrical stimulation

and Active muscle contraction) and group B (Electrical stimulation) by using lottery method. A written informed consent was taken from each participant. Ethical clearance was obtained from university's institutional review board. Inclusion criteria were both male and female subjects symptomatically, exposure to cold. Exclusion criteria were below the age of 15 years of age, pregnancy, Pacemaker insertion status.

Both Group were treated with Galvanic current was used to stimulate the facial muscles and faradic current was used for each facial nerve trunks. Mode with 100 millisecond intermittent galvanic current for motor point treatment, 30 times as 3 rounds to each point, and at a current intensity as to obtain minimal contraction. 30 contractions were given to each muscle in 3 sessions and 10 contractions were given to each facial nerve trunk. Electrical stimulation was given to patients once daily until patient able to do.

The patients in both groups asked try to doing facial exercises in front of mirror during the exercise program for visual feedback

3.1 Outcome Measure

Subjects in both the Groups were evaluated pre and post treatment program using HBS and MMT.

3.2 HBG Scale

The HBGS (House Brackmann Grading Scale) is used to assess patients' facial symmetry.

4. Statistical Analysis

Statistical analysis for the present study was done manually as well as by using the INSTST so as to verify the results obtained. Various statistical measures such as Paired t test, unpaired t test. Intra Group comparison (within Group) was analysed statistically using paired test for HBS Score, inter Group comparison (between Group) was analysed statistically using Unpaired t test. Probability values less than 0.05 were considered statistically significant and probability values less than 0.0001 were considered statistically extremely significant.

5. Results

30 subjects with Bell's palsy, above the age 15 years were taken. Out of 30 subjects, Group A had 7 males, and 8 females and Group B had 8 males, and 7 females. The mean age of the participants in Group A was 41± 21.458 and in Group B was 40 ± 17.397. There was no significant difference between the mean ages of the participants in both groups. (P= 0.8968)

Table 1: Baseline characteristics of participants

Variable	*Group A*	*Group B*
Sex	M= 7$ F=8	M=8$ F=7
Age	41±21.458	40± 17.397

In present study pre – interventional mean of HBS score was 4.5333 ± 0.7432 in Group A and 4.8666 ± 0.6399 in Group B whereas post-intervention ally means HBS score was 3.4666± 0.6399 in Group A and 2 ± 0.7559 in Group B respectively.

Intra group statistical analysis revealed statistically extremely significant increase in HBS score post interventional for both the groups. This was done by using paired't' test Group A (t_{14}=13.201, p<0.0001), Group B (t_{14}=10.693, p<0.0001).

Pre intervention analysis showed no significant difference between Group A and Group B(p= 0.1987). Post intervention analysis showed significant difference between Group A and Group B (p= <0.0001)

Table 2: Comparison of HBS scores in between groups

Group	*Pre- treatment*	*Post-treatment*	*'p'*	*'t'*
	Mean ± SD	Mean ± SD		
A	.5333 ± 0.7432	3.4666± 0.6399	0.1987	13.201
B	.8666 ± 0.6399	2 ± 0.7559	<0.0001	10.693

In the present study pre interventional mean occipital frontalis MMT was 0.6 ± O.5071 in Group A and 0.666 ± 0.5071 in Group B whereas post-intervention occipitofrontalis MMT was 2.6 ± 0.5071 in Group A and 1.9333 ± 0.4577 in Group B respectively.

Intra group statistical analysis revealed statistically extremely significant increase in occipitofrontalis MMT post interventional for both the groups. This was done by using paired t test Group A (t_{14}=20.494, p<0.0001), Group B (t_{14}=10.583, p<0.0001).

Pre intervention analysis showed no significant difference between Group A and Group B(p= 0.0004). Post intervention analysis showed significant difference between Group A and Group B (p= <0.0001).

Table 3: Comparison of occipitofrontalis MMT

Group	*Pre- treatment*	*Post-treatment*	*'p'*	*'t'*
	Mean ± SD	Mean ± SD		
A	0.6± 0.5071	2.6± 0.5071	0.0004	20.494
B	0.6 ± 0.5071	1.9333 ± 0.4577	<0.0001	10.583

In the present study pre interventional mean orbicularis oculi MMT was 0.5333 ± 0.5164 in Group A and 0.6 ± 0.5071 in Group B whereas post-interventional mean of orbicularis oculi MMT was 2.5333 ± 0.5164 in Group A and 1.9333 ± 0.4577 in Group B respectively.

Intra group statistical analysis revealed statistically extremely significant increase in orbicularis oculi MMT post interventional for both the groups. This was done by using paired t test Group A (t=14.491, p<0.0001), Group B (t=8.367, p<0.0001).

Pre intervention analysis showed no significant difference between Group A and Group B(p= 0.7240). Post intervention analysis showed significant difference between Group A and Group B (p=0.0022).

Table 4: Comparison of orbicularis oculi MMT in between groups

Group	*Pre- treatment*	*Post-treatment*	*'p'*	*'t'*
	Mean ± SD	Mean ± SD		
A	0.5333 ± 0.5164	2.5333 ± 0.5164	0.7240	14.491
B	0.6 ± 0.5071	1.933± 0.4577	0.0022	8.367

In the present study pre interventional mean orbicularis oris MMT was 0.5333 ± 0.5164 in Group A and 0.4 ± 0.5071 in Group B whereas post-interventional mean of orbicularis oris MMT was 2.666 ± 0.4880 in Group A and 1.7333 ± 0.5936 in Group B respectively.

Intra group statistical analysis revealed statistically extremely significant increase in orbicularis oris MMT post interventional for both the groups. This was done by using paired t test Group A (t_{14}=16.000, p<0.0001), Group B (t_{14}=8.367, p<0.0001).
Pre intervention analysis showed no significant difference between Group A and Group B (p= 0.4814). Post intervention analysis showed very significant difference between Group A and Group B (p=<0.0001).

Table 5: Comparison of orbicularis oris MMT in between groups

Group	*Pre- treatment*	*Post-treatment*	*'p'*	*'t'*
	Mean ± SD	Mean ± SD		
A	0.5333 ± 0.5164	2.666 ± 0.4880	0.4814	16
B	0.4 ± 0.5071	1.7333 ± 0.5936	<0.0001	8.367

In the present study pre interventional mean shoulder adduction range was 0.4 ± 0.5071 in Group A and 0.2666 ± 0.4577 in Group B whereas post-interventional mean of buccinators MMT was 2.666 ± 0.4880 in Group A and 1.6 ± 0.6325 in Group B respectively.

Inter group analysis no significant difference between group A and group B. Post (p<0.0001) interventional analysis showed extremely significant difference between group A and group B.

Table 6: Comparison of buccinators MMT in between groups

Group	*Pre- treatment*	*Post-treatment*	*'p'*	*'t'*
	Mean ± SD	Mean ± SD		
A	0.4 ± 0.5071	2.666 ± 0.4880	0.4560	19.179
B	0.2666 ± 0.4577	1.6 ± 0.6325	<0.0001	8.367

In the present study pre interventional mean nasalize MMT was 0.5333± 0.6399 in Group A and 0.5333 ± 0.6399 in Group B whereas post-interventional mean of nasalize MMT was 2.666 ± 0.4880 in Group A and 1.866 ± 0.7432 in Group B respectively.

Inter group analysis of nasalize MMT was done by using unpaired t test. Pre interventional analysis showed no significant difference between group A and group B (p=>0.999). Post intervention analysis showed very significant difference between Group A and Group B (p=0.0016).

Table 7: Comparison of nasalize MMT in between groups

Group	*Pre- treatment*	*Post-treatment*	*'p'*	*'t'*
	Mean ± SD	Mean ± SD		
A	0.5333± 0.6399	2.666 ± 0.4880	>0.999	16
B	0.5333 ± 0.6399	1.866 ± 0.7432	0.0016	10.583

In the present study pre interventional mean masseter MMT was 0.7333 ±0.5936 in Group A and0.7333 ± 0.4577 in Group B whereas post-interventional mean of masseter MMT was 2.6 ± 0.5071 in Group A and 2 ± 0.5345 in Group B respectively.

Inter group analysis of masseter MMT was done by using unpaired t test. Pre interventional analysis showed no significant difference between group A and group B (p=> 0.999). Post intervention analysis showed very significant difference between Group A and Group B (p=0.0038).

Table 8: Comparison of masseter MMT in between groups.

Group	*Pre- treatment*	*Post-treatment*	*'p'*	*'t'*
	Mean ± SD	Mean ± SD		
A	0.7333 ±0.5936	2.6 ± 0.5071	>0.999	14
B	0.7333 ± 0.4577	2 ± 0.5345	0.0038	10.714

In the present study pre interventional mean temporalis MMT was 0.7333 ±0.5936 in Group A and 0.7333 ± 0.5936 in Group B whereas post-interventional mean of temporalis MMT was 2.533 ± 0.5164 in Group A and 21.933± 0.4577 in Group B respectively.

Inter group analysis of temporalis MMT was done by using unpaired t test. Pre interventional analysis showed no significant difference between group A and group B (p= > 0.999). Post intervention analysis showed very significant difference between Group A and Group B (p=0.0022).

Table 9: Comparison of temporalis MMT in between groups.

Group	*Pre- treatment*	*Post-treatment*	*'p'*	*'t'*
	Mean ± SD	Mean ± SD		
A	0.7333 ±0.5936	2.533 ± 0.5164	>0.999	16.837
B	0.7333 ± 0.5936	1.933± 0.4577	0.0022	11.22

In the present study pre interventional mean mentalis MMT was 0.666 ±0.4880 in Group A and 0.7333 ± 0.4577 in Group B whereas post-interventional mean of mentalis MMT was 2.2 ± 0.5606 in Group A and 1.666 ± 0.4880 in Group B respectively.

Inter group analysis of mentalis MMT was done by using unpaired t test. Pre interventional analysis showed no significant difference between group A and group B (p= o.7025). Post intervention analysis showed very significant difference between Group A and Group B (p=0.0096).

Table 10: Comparison of mentalis MMT in between groups

Group	*Pre- treatment*	*Post-treatment*	*'p'*	*'t'*
	Mean ± SD	Mean ± SD		
A	0.666 ±0.4880	2.2 ± 0.5606	0.7025	0.0096
B	0.7333 ± 0.4577	1.666 ± 0.4880	11	14

6. Discussion

The study "Effect of Electrical stimulation and active muscle contraction in Bell's palsy" was conducted to compare the two treatments and find out the best which improves the facial expression as early as possible. Expressions in Bell's palsy become the major limiting factor for subjects. It causes social impairment and also functional impairments. It affects self-esteem. This study shows significant difference in the pre and post treatment values in both the groups.

Electrical stimulation and active muscle contraction as group A showed significant improvement in the outcome variables concluding that it early recovery of the facial expression This was confirmed using statistical analysis by using 'Paired t-test' for within group comparison and 'Unpaired t-test' for between the group comparisons. In the present study, we found that after intervention there was significant improvement in the outcome with Group A. It is effective in improving facial expression.

In Group A was given, electrical stimulation and active muscle contraction in thatvoluntary contraction produces a stronger contraction than electrical stimulation. This is due to the fact that voluntary contraction provokes not only the contraction of a single muscle, but of an entire muscular chain, in addition to generating complex activity. Meanwhile, electrical stimulation only cause hypertrophy at the level of the sarcomeres, but it does not influence coordination process (functional training), so that Group A is very significant as compared Group Active muscle contraction and electrical stimulation has been claimed to strengthen and increase endurance of muscle paralyses.

In group A, to facilitate recovery of muscle strength and coordination in bell's palsy. However the significantly increase voluntary muscle output. Increase their muscle circumference as shown on CT or MRI. Muscle biopsy studies have shown a switch from myosin heavychain(MHC) isoform II B muscle fibres (fast twitch, fast fatigable) to MHC isoform II fibres(fast twitch, fast fatigable), with such active muscle contraction. This active muscle contraction and electrical stimulation studies have confirmed the reversibility of disuse changes in muscle paralyzed by Bell's palsy.

In Group B was given only electrical stimulation in that Muscles comprise of bundles of muscle fibres and there are many nerves that supply each muscle fibres. These nerves the key element might be the degree to which learner was actively involved in problem solving. In group B patients received only electrical stimulation. Although this practice order might have produced improved early acquisition of skills, retention and generalizability of skill might be less. These all considerations can be supported by a statement by Kottke[13] that if the practiced activity has been precise, the engram will be precise i.e. "Practice doesn't make perfect" rather, when it comes to motor engrams "Perfect Practice make Perfect". This accounts to better improvement in group A as compared to group B. In summary, the study shows very significant difference in pre & post values. Group A improves the facial expression in all the outcome measures. Group B also improve facial expression but it late recovery as compare Group

It was significant improvement noted in group A in all, this suggests that Group A is effective in improving facial expressions. This might be because of active muscle contraction which helped in improving motor control of facial muscle and motor learning in action with respect to Group A, might have helped the patients to have better motor planning and motor relearning. It may cause the specific recruitment of the motor units specifically for the facial activation.

7. Conclusion

Various conservative approaches are used in treating Bell's palsy but present study shows that Electrical stimulation with active muscle contractions simultaneously is better than only electrical stimulation.

8. Further Scope

Future follow up of the patients were not taken. The patients were not homogeneous. The Sample size used in this study was relatively small. This makes it difficult to extrapolate the results on general population. This study can be done on people with less than 15 years. This study can be done on larger population with specific categorization of patients; Infectious causes can be used.

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