



Effects of Low Power Laser and Electrical Stimulation on Facial Function at Unilateral Sub-Acute Stage of Bell's Palsy

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Raied sami alajeeli¹, Isam Ali Hameedi², Siamak Bashardoust Tajali³, mohammed Ali Hassan⁴,
Gholamreza Olyaei⁵, Dr. Kazem Malmir⁶.

¹MSc. PT, Physical Therapy Department, School of Rehabilitation, Tehran University of Medical Sciences,
Tehran, Iran, tehtanu22@gmail.com

²MSc., PT, Physical Therapy Department, School of Rehabilitation, Tehran University of Medical
Sciences, Tehran, Iran, isam_jettar@yahoo.com

³PT. PhD., Department of Physiotherapy, School of Rehabilitation, Tehran University of Medical
Sciences, Tehran, Iran. s_bashardoust@sina.tums.ac.ir

⁴MSc. PT, Physical Therapy Department, School of Rehabilitation, Tehran University of Medical Sciences,
Tehran, Iran, mohmdg@gmail.com, 0000-0003-3217-1894

⁵PT. PhD., Department of Physiotherapy, School of Rehabilitation, Tehran University of Medical
Sciences, Tehran, Iran. olyaeigh@sina.tums.ac.ir +98 (21) 77528469, ORCID ID:0000-0001-9573-1348.

⁶PT. PhD., Department of Physiotherapy, School of Rehabilitation, Tehran University of Medical
Sciences, Tehran, Iran. Dr. Kazem Malmir Assistant Professor. kmalmir@sina.tums.ac.ir. ORCID ID:000-
0002-0801-2597.

Corresponding author: PT. PhD., Department of Physiotherapy, School of Rehabilitation, Tehran
University of Medical Sciences, Tehran, iran.s_bashardoust@sina.tums.ac.ir

Abstract

Objective: To compare between three groups (LLLTT with EXS and IDC with EXS and EXS only to identify which group of patients with sub-acute bell's palsy may have better improvement following the identified interventions. Moreover, we want to identify how much the LLLTT application may affect the recovery following sub-acute Bell's palsy.

Method: Fifty-one patients with sub-acute bell's palsy participated in the current study. They randomly divided Interrupted direct current with Exercise, but group C received just exercises. The participants were in three groups each group containing 17 patients. group A received 15 sessions in three-week .5 sessions per week. and group B received 9 sessions in three weeks,3 sessions per week. And the third group received 5 exercises, each Exercises reputation10 times .the assessment of patient with NCS , HBS and VAS.

Results: The overall results of this study shows that there was significant reduction in perception of pain in terms of VAS ($P = 0.00$)and there are three intervention groups showed a significant difference in the function of facial muscle ($P = 0.00$), While no significant differences between the effectiveness of exercise intervention techniques (before, after) on the function of facial muscles

Also, there was a statistically highly significant difference in mean of house brakeman scale increase. ($P = 0.00$) and housebreak man scale increase (follow-up) between the three groups of treatments at a P-value \leq of 0.05. and Visual analog scale VAS increase showed that there was no significant difference between the three groups.

Keywords: Bell's palsy (BP) Low level laser therapy (LLLTT), Interrupted direct current. (IDC) Visual analog scale (VAS), House brakeman scale (HBS), Nerve conduction study (NCS).

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Conclusion: The overall results of this study shows that there was significant reduction in perception of pain in terms of VAS ($P = 0.00$) and there are three intervention groups showed a significant difference in the function of facial muscle ($P = 0.00$), While there are no significant differences between the effectiveness of exercise intervention techniques (before, after) on the function of facial muscles

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Introduction

Bell's palsy, is an Idiopathic facial paralysis leads to provoke loss of motion within the face¹. A few of the literary works detailed that idiopathic facial paralysis might be considered as a portion of a generalized subclinical mono neuritis multiplex or polyneuropathy¹. A few others detailed that Bell's paralysis may be considered as portion of cranial polyneuropathy². Bell's paralysis is an intense fringe nerve palsy affecting the facial nerve (seventh cranial nerve), which supplies the facial muscles, additionally the parasympathetic filaments which included within the facial nerve to supply the salivary and lacrimal organs conjointly limited tactile fiber providing the front 2/3 of the tongue for taste function³. Bell's paralysis is the lower engine neuron injury or disease, which happen as a complicated clutter within the neuromuscular facial portion with obscure etiology and influences the facial nerve or seventh cranial nerve, causing ipsilateral facial loss of motion or paresis within the facial expression muscles⁴

The confront is the self-evident portion of the human body, which mentally exceptionally critical within the common expression. The pathophysiology of Bell's paralysis can be clarified as a fiery condition influencing the facial nerve that driving to axonal demyelination and unsettling influence of the blood supply to the nerve of face⁵. The neurotic prepares of Bell's paralysis influences muscles of the facial appearance, salivary organs and tactile strands that supply taste sensation⁵. It happens within the lacrimal organs driving to intemperate

lacrimation (over the top tearing) or dryness (intemperate dry mouth⁵).

The title of Bell's paralysis (BP) alludes to Scottish anatomist and specialist, Sir Charles Chime, and recognizes an infection that happens as a result of (7) cranial (facial) nerve dysfunction⁵. It is characterized by facial loss of motion, driving to a failure to control the facial muscles on the influenced side with obscure causes and is the foremost common intense mononeuropathy⁶.

Bell's paralysis is an acute-onset fringe facial neuropathy and is the foremost common cause of lower engine neuron facial paralysis⁷. The clinical introduction of the clutter could be a fast onset, one-sided, lower engine neuron-type facial shortcoming with going with side effects of post auricular pain, disguise, subjective change in facial sensation and hyperacusis⁸

In spite of broad ponders of the case, the precise pathogenesis of Bell's paralysis is still questionable. Disease (herpes simplex type-1), nerve compression and autoimmunity are detailed as a few conceivable common causes⁶. Around 60% - 70% of all cases are unilateral⁸. In spite of the fact that it is thought to happen as a result of vascular ischemia, autoimmunity or viral disease of the nerve sheath, the precise etiology and pathogenesis of Chimes; paralysis are still debated⁶. The foremost common worthy etiology may be a viral infection⁹. Physiotherapy has been detailed as a major treatment strategy of recovery for BP patients since 1972. Physical Therapy methods may offer assistance to diminish torment, increment muscle work, create facial symmetry, and anticipates the event of complications¹⁰. The exact sequence and magnitude of these influences remain unclear.¹⁰

Materials and Methods.

This is a comparative study with Pre- posttest study design. This study was approved by Ethics Committee of Tehran University of Medical Sciences. A total of 51 participants were recruited from the Imam sadiq Hospital, Hilla teaching Hospital and Merjan Medical City in the Physical Therapy Department/Babil - Iraq according to the inclusion and exclusion criteria for the present study. Were Age between 20-70 years, presence Sub-acute Bell's palsy was the



inclusion criteria Age between 20 – 70 years. Both genders. The patients are diagnosed/suspected for Bell's palsy in sub-acute stage by a specialist (neurologist, neurosurgeon).Unilateral side of the patient face must be affected following the Bells palsy. No background for any kind of musculoskeletal or neurological disorders. Able to read and write in Arabic .and Exclusion criteria were included. History of trauma and neurologic condition. Hearing loss in association with facial paralysis.

Recurrent facial nerve lesion. The patients who will be absent for two or more continuous sessions .Sensitivity to electrical stimulation. Fear of pain. A randomized controlled trial (RCT) was designed for the study was permitted by the Ethics Committee of Tehran University of Medical Sciences (TUMS) 00989, Approval date2021-03-9, 1400/01/05.IIR.TUMS.FNM.REC.1399.232 (dated.99/12/19).

Study design

In order to assess the efficacy of LLLT with patient of sub-acute bell's palsy. All participants recruited for this study after a specialist in, neurologist or rheumatologist diagnosed them with sub-acute bell's palsy .All of the participants (31.Females and 20. Males, were checked for the inclusion and exclusion criteria written consent explained and signed by the selected participants to assure their permission. In the written consent, all advantages and possible disadvantages explained clearly to the patient's before the starting the treatment intervention. In addition, we advised the patients to avoid other treatments or medications at home.

Assessment:

By using (VAS) (visual analog scale (assessment of pain)

Visual analog scales: The pain intensity was evaluated using the VAS. The VAS is 10 cm long, fixed with the words “no pain” and “worst pain imaginable” at the opposite ends. Participants were asked to spot a point along the scale that best represented the level of pain experienced before intervention and after the last session, As shown in Figure 1.

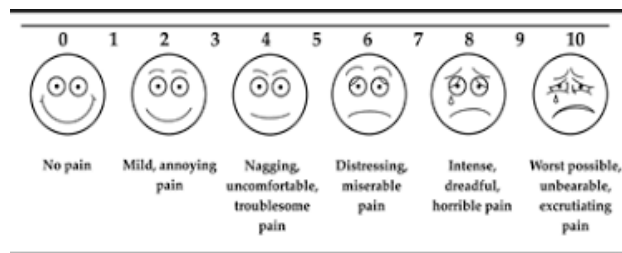


Figure 1 Visual analog scales

House Brakeman scale. Classified as a universal scale by the. American Academy of Otolaryngology, Committee of. Disorders of the Facial Nerve. It was proposed and modified by House brakeman scale

HBC (House Brakeman scale) (using of assessment nerve of muscle function)

Been extended to be the most accepted scale for assessing facial. Nerve palsy because of its ease of use and clinical sensitivity. This scale analyzed the symmetry, silkiness, stiffness, and global mobility of the face (Table 1).

Grade	Description	Characteristics
I	Normal	Normal facial function
II	Mild dysfunction	Slight weakness on close inspection; normal tone and symmetry at rest
III	Moderate dysfunction	Obvious weakness +/- asymmetry, but not disfiguring; synkinesis, contracture or hemifacial spasm; complete eye closure with effort
IV	Moderately severe dysfunction	Obvious weakness or disfiguring asymmetry; normal symmetry and tone at rest; incomplete eye closure
V	Severe dysfunction	Barely perceptible motion; asymmetry at rest
VI	Total paralysis	No movement

Table 1. House Brakeman scale

Intervention

The first group low level laser with Exercises.Seventeen subjects received 15 sessions of treatment through three weeks, five sessions per week. The EPIC TM X diode laser system surgical and therapeutic device BIOLASE



was applied for this study. Low-level laser therapy was applied with the following specifications: The probe does have 830 nm wavelengths. And Energy density will be applied with 10 J / cm² for each point of application. And the laser irradiation will be at the mode of continuous. And. The laser producer output is 100 mW and frequency 1Khz using therapeutic device / BIOLASE; as a result, the duration of exposure for each selected point will be 100 seconds and the total time of laser exposure for 10 points will be around 1000 seconds equal 16 minutes and 40 seconds.

The second group (Interrupted direct current with Exercises) received 9 sessions of treatment over three weeks, three sessions per week. The duration of muscle stimulation was 10 MS (it can be increased up to 100 MS in case of not responding), with a frequency of 50 HZ and 1-second rest for a total period of 50 seconds (about 50 contractions) for each muscle, three sessions per week to avoid any possible complication of fatigue.

The third group received 5 exercises for each Exercises reputation 10 times for some facial muscles. We were applying the following exercises of facial muscle 5 times per day for a period of three weeks for all patients of this study.

Statistical analysis: All statistical analysis was analyzed by SPSS statistical software, version 21. The Kolmogorov- Smirnov (K-S) test was used to assess the normality of the data. Paired t-test was used to compered the before- after values of the variables. Alpha level was considered at 0.05 for all of the statistical tests.

Results:

Fifty-one participants included 20 males and 31 females participated in the present study. The average age was 42 years for the participate. As shown in Table (2,3,4,5,6) All variables were normally, distributed based on the result of the K. S test (p > 0.05), according to the results of paired t-test, all three intervention groups showed a significant difference in the function of facial muscle and Pain intensity. While there are no significant differences between the effectiveness of exercise intervention techniques (before, after) on the function of facial muscles in relation to Frontalis Amplitude at a P-value ≤ of 0.05. The changes of HBS in LLLT group were

estimated to be 4.59 (1.064) before, 1.59(0.618) after, 1.00(0.707) Follow-up, 3.00(1.173) improvement mean (SD) and the changes were significantly different (p = 0.00). Also the changes of HBS in IDC group were estimated to be 4.53(1.068) before, 3.35 (0.996) 3.06 (0.827)after 1.18(0.809) Follow-up, 1.47(0.800) improvement mean (SD) and the changes were significantly different (p = 0.00) the changes of HBS in Exercise group were estimated to be 4.65(1.057) 3.59 (0.870) before, 3.59(0.870) after, 1.06(0.659) Follow-up 1.06(0.659) improvement mean (SD) and the changes were significantly different (p = 0.00) the changes of VAS in LLLT group were estimated to be 8.41(1.064) 0.41(0.507) 1.21(2.172) improvement mean (SD) and the changes were significantly different (p = 0.00). There is no significant difference in mean difference between three groups of intervention. The changes of VAS in Interrupted direct current group were estimated to be 8.82(1.334) 1.65(0.493) 1.15(1.949) improvement mean (SD) and the changes were significantly different. (p = 0.00). The changes of VAS in Exercises group were estimated to 9.24(0.664) 9. 1.82 1.09(1.733) improvement mean (SD) and the changes were significantly different (p = 0.00).

Treatment groups	Time	Mean	Std. Deviation
LLLT Group low level laser therapy (N=17)	Before	8.41	1.064
	After	0.41	.507
	improvement	1.21	2.172
interrupted direct current (N=17)	Before	8.82	1.334
	After	1.65	.493
	improvement	1.15	1.949
exercise(N=17)	Before	9.24	.664
	After	1.82	.728
	improvement	1.09	1.733

table (2) .Show that best improvement in LLLT more than IDC group intervention and less improvement with EXS group intervention



Treatment groups	Time	Mean	SD
Exercise only (N=17)	Grade before treatment	4.65	1.057
	Grade after treatment	3.59	.870
	Follow-up after three weeks	3.59	.870
	Improvement	.106	.659
	Follow-up Improvement	1.06	.659
interrupted direct current (N=17)	Grade before treatment	4.53	1.068
	Grade after treatment	3.35	.996
	Follow-up after three weeks	3.06	.827
	Improvement	1.18	.809
	Follow-up Improvement	1.47	.800
Group low level laser therapy (N=17)	Grade before treatment	4.59	1.064
	Grade after treatment	1.59	.618
	Follow-up after three weeks	1.00	.707
	Improvement	3.00	1.173
	Follow-up Improvement	3.59	1.278

(Table 3). The results were evaluated according to the House- Brakeman Scale.

Variable	Sum of Squares	Df	Mean Square	F	Sig
VAS	.118	2	.059	015	.985
HBS	40.275	2	20.137	4.525	.000

(Table 4). Comparison the Mean of VAS, HBS improvement between three groups of intervention by ANOVA test (n=51)

Affected side		Treatment groups			Total
		Group(low level laser therapy) (N=17)	Group interrupted direct current (N=17)	Group exercise only (N=17)	
Right side Injury	Count	11	12	12	35
	% of Total	21.6%	23.5%	23.5%	68.6%
Left side Injury	Count	6	5	5	16
	% of Total	11.8%	9.8%	9.8%	31.4%
Total	Count	17	17	17	51
	% of Total	33.3%	33.3%	33.3%	100.0%

(Table5). Distribution of the studied groups according to affected side (n=51)



Gender		Treatment groups			Total
		Group low level laser therapy (N=17)	Group interrupted direct current (N=17)	Group Exercise only (N=17)	
Male	Count	5	8	7	20
	% of Total	9.8%	15.7%	13.7%	39.2%
Female	Count	12	9	10	31
	% of Total	23.5%	17.6%	19.6%	60.8%
Total	Count	17	17	17	51
	% of Total	33.3%	33.3%	33.3%	100.0%

(Table 6) Distribution of the studied groups according to gender (n=51)

Discussion:

In this study, we compared the LLLT, IDC, and EXS only. Before and after 15 sessions for laser and 9 sessions of IDC of therapies, based on our results after 15 session of laser (830 nm, / wks.) finding a significant difference between Pre-post therapies. According to the literature review of the authors, the studies were found to have conflicting results with the current study, as well as similarities with our study, and our study demonstrated the positive effects of this therapeutic intervention.

Some limitations of this study should be acknowledged. First, patients not satisfied with the discomfort associated with IDC. In addition, patients not attended treatment sessions due to COVID crisis.

The face is the obvious part of the human body, which psychologically very important in the general expression (Ho et al., 2012) 6. Bell's palsy is considered the most extended type of facial paralysis or paresis, which idiopathic nature, may be due to facial nerve inflammation at the geniculate ganglion, leading to demyelination, possible ischemia, and compression (Tiemstra & Khatkhate, 2007).7

The result of this study showed that the application of LLLT + Exs has much beneficial on the function of facial muscles in patients with sub-acute Bell's palsy.

We did not find any significant differences in pain intensity between laser and conventional physiotherapy groups.

- Hernandez et al. (2012) did not report any difference between the groups.

Delgado Castillo et al. (2013) did not identify any effectiveness following 4-week LLLT application (wavelength 670 nm) on Bell's palsy.8

- Murakami et al. (1993) compared the efficacy of stellate ganglion block (SGB) with an infrared diode laser (830 nm), and the combination of both treatments in patients with sub-acute BP in an RCT. These researchers found that the patients in the LLLT group registered faster initial recovery and a little better final paralysis scores than other groups.

Alayat et al. (2013) found that laser therapy is an effective physical therapy modality for the recovery of patients with Bell's palsy. Both HILT and LLLT were more effective than facial massage and exercises alone.9

Aghamohamdi et al. (2020) studied efficacy of HILT and LLLT in treatment of Bell's palsy in Diabetic patients with Bell's palsy. The HILT has more substantial effects than LLLT. These researchers found evidence that the LLLT improved pain, physical function, and activities in the patients with Bell's palsy. .10



Clinical implication

The results of this study provide that LLLT has positive effects on active sub-acute Bell's palsy. Of pain relief and increasing the face function muscles.

Conclusion:

The outcome of this study demonstrates that the application of Low power laser with exercises to specific points of the face muscles has more effects on reducing pain and increase functional activity in patients with sub-acute bell's palsy and more effective when compared to conventional physiotherapy, this intervention may be particularly crucial for patients who do not get improvement by medical therapy, who suffer side effects from drugs, or diabetic patients.

Ethical Considerations.

Compliance with ethical guidelines this ethical approval was issued by the Ethics Committee in Research School of Nursing and Midwifery and School of Rehabilitation - Tehran University of Medical Sciences, under the ethical code;00989, Approval date 2021-03-9, 1400/01/05 IIR.TUMS. FNM.REC.1399.232 (dated.99/12/19).

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Authors' contributions.

All authors contributed in the study design, data analysis, interpretation of data, and writing and editing the original draft.

Conflict of interest.

The authors declared no conflict of interest.

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REFERENCES

1. Oguz H, Tunc T, Safak MA, Inan L, Kargin S, Demirci M. Objective voice changes in nondysphonic Parkinson's disease patients. *J Otolaryngol.* 2006 Oct;35(5):349-54.
2. Benatar M, Edlow J. The spectrum of cranial neuropathy in patients with Bell's palsy. *Arch Intern Med.* 2004 Nov 22;164(21):2383-5.
3. de Ru JA, van Benthem PP, Janssen LM. Is antiviral medication for severe Bell's palsy still useful? *Lancet Neurol.* 2009 Jun;8(6):509; author reply 509-10.
4. ELLIOTT J.M. Physiotherapy treatment of Bell's palsy: *New Zealand Journal of Physiotherapy*,2006; 34(3); 11-14.
5. PHAM V., YOUNG D., & MAKISHIMA T. Bell's palsy: Diagnostic and treatment considerations. *The University of Texas Medical Branch (UTMB Health)*2012;23-35.
6. Eviston TJ, Croxson GR, Kennedy PG, Hadlock T, Krishnan AV. BP: aetiology, clinical features and multidisciplinary care. *J Neurol Neurosurg Psychiatry*; 86:1356-61: 2015.
7. Peitersen E. BP: the spontaneous course of 2,500 peripheral facial nerve palsies of different etiologies. *Acta Otolaryngol Suppl*, 549:4-30: 2002.
8. Greco A, Gallo A, Fusconi M, Marinelli C, Macri GF, deVincentiis M. BP and autoimmunity. *Autoimmune Rev.* 12:323-8:2012.
9. DYCK P.J. Companion to peripheral neuropathy: Illustrated cases and new developments Elsevier Health Sciences2010; 9:289-311.
10. LJUSTAD U., OKSTAD S., TOPSTAD T., MYGLAND A., MONSTAD P. (2005) Acute peripheral facial palsy in adults. *J Neurol*; 252: 672-6.

