

# Efficacy of Proprioceptive Neuromuscular Facilitation and Kinesiology Taping in Patients with Bell's Palsy

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**Abstract:** *The purpose of the present study was to determine the efficacy of proprioceptive neuromuscular facilitation and kinesiology taping along with conventional physiotherapy and electrical muscle stimulation in patients with Bell's palsy. In present study, conveniently selected 21 patients both male and female with Bell's palsy of age group 20 to 50 years were considered. Further the patients were allocated equally into three groups, Group A, B and C having seven patients in each group. Patients in group A received proprioceptive neuromuscular facilitation, conventional physiotherapy and electrical muscle stimulation. Group B received kinesiology taping, conventional physiotherapy and electrical muscle stimulation. Group C received conventional physiotherapy and electrical muscle stimulation. The outcome measures included Facial Disability Index-Physical Function and Social Function (FDI-PF, SF) and Sunnybrook Facial Grading Scale (SFGS) for facial motor function and facial symmetry. Results of the study showed that in pre-intervention condition, no significant differences were noted in the scores of FDI-PF, SF and SFGS between the groups. However, significant differences ( $p < 0.05$ ) were noted in post-intervention scores of FDI-PF, SF and SFGS of group B when compared to other two groups i.e., group A and group C. From the findings of the study it could be concluded that the treatment protocol comprised of Kinesiology Taping, Conventional Physiotherapy and Electrical Muscle Stimulation was more effective than Proprioceptive Neuromuscular Facilitation, Conventional Physiotherapy and Electrical Muscle Stimulation in improving the facial symmetry and facial motor function in patients with Bell's palsy.*

**Keywords:** Bell's palsy, Electrical Muscle Stimulation, Kinesiology Taping, Proprioceptive Neuromuscular Facilitation

## 1. Introduction

Bell's palsy is an acute, unilateral, peripheral, lower motor neuron facial nerve paralysis. The onset of Bell's palsy is acute and about one half of cases attain maximum paralysis in 48 hours and practically all within 3 or 4 days. In rare cases (1%) it can occur bilaterally. Bell's palsy also known as idiopathic facial paralysis is the most common cause of unilateral facial paralysis. The annual incidence of Bell's palsy is 20-30 per 100,000, and a lifetime incidence of one in 60-70 people<sup>1</sup>. It can occur at any age, with the peak of incidence between 15-45 years of age<sup>2</sup>. The cause of Bell's palsy is uncertain. It is thought that reactivated herpes virus at the geniculate ganglion of the facial nerve may play a key role in the development of Bell's palsy. Herpes simplex virus (HSV)-1 has been detected in up to 50% of cases by some researchers<sup>3</sup>. Association with other infectious pathogens, such as cytomegalovirus, Epstein-Barr virus, mumps, rubella, and human immunodeficiency virus has also been shown. Moreover, microcirculatory disorders induced by atherosclerosis have been reported to increase the accumulation of lipids resulting in luminal obstruction and ischemia<sup>1</sup>. Clinical Symptoms include inability to close the eye and smile on the affected side. Patient may report increased salivation on the side of paralysis, posterior auricular pain, decreased tearing, taste disturbance, tingling of cheek or mouth and blurred vision<sup>4</sup>.

Treatment of Bell's palsy is divided into acute and maintenance treatment. The acute treatment consist of using corticosteroids and antiviral that must be initiated within the

first 72 hours after the onset of clinical signs<sup>2</sup>. The maintenance treatment includes interventions such as eye care, mouth care, botulinum toxin injections, even complementary medicine treatment such as acupuncture and Physiotherapy which includes electrical stimulation, PNF and facial exercises. Studies have stated that patients treated with electrical stimulation produce "mass action" it is generalized contraction of facial muscles with attempted facial expression. EMS has been used to minimize atrophy and maintain contractile properties of the muscle. Whereas Proprioceptive Neuromuscular Facilitation is a manual resistance technique that works by stimulating fundamental patterns of movement, it either facilitates or inhibits the movement. It has been reported that it improves function of facial muscles, flexibility, strength and co-ordination. Most often voluntary facial contraction or expressions are combination of facial movements, for this reason facial movements are easily distorted in resting facial posture or voluntary contraction in any region of face<sup>5</sup>. Unlike other skeletal muscles facial muscles lack fascial encasement and tendons. The intrinsic muscle receptors and joint receptors are few in the face. Various facial muscle exercises are given to the patient to be performed in front of mirror, so that patient gets visual feedback and can perform exercises more efficiently<sup>6</sup>. The recent approach for management of Bell's palsy is dynamic taping using kinesiology tape with facial exercise. It is a therapeutic tool. Kinesiology tape uses latex-free tape that is structurally similar to the human skin, and is 100% heat activated acrylic adhesive which used in conjunction with other physical modalities in rehabilitation of some musculoskeletal and neurological conditions. The

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inventor of the method, Dr. Kenzo Kase, proposed that KT exerts its effects by several mechanism: by being stretched to 120-140% of its original length and recoiling to its original length following application, this tape can exert pulling force on the skin moreover, it decreases pain by stimulating the neurological system, it restores correct muscle function by supporting weakened muscles, reduces congestion of lymphatic fluid or edema under the skin, and it decreases muscle spasm<sup>7-9</sup>.

The aim of present study was to find the efficacy of Proprioceptive Neuromuscular Facilitation and Kinesiology taping in patients with Bell's palsy.

## 2. Materials and Methods

**Study Setting and Study Design:** The study was quasi experimental in nature and was conducted at Department of Neurology, Department of Medicine, Department of ENT, GGS Medical College and Hospital and OPD, University College of Physiotherapy, Faridkot, India during 2021-2022. The study was approved by the ethical committee of University College of physiotherapy, Baba Farid University of Health Sciences. The subjects were thoroughly explained about the procedure prior to participation in this study and their informed written consent was taken.

**Procedure:** A total of 21 patients (both male and female) aged between 20-50 years diagnosed with unilateral Bell's palsy having acute onset (1-3 weeks) and non traumatic cause were included in the study and patients with bilateral facial weakness having demyelinating neuropathy, upper motor neuron lesion facial paralysis, sensory loss over face, any other ENT impairment, recurrent Bell's palsy and patients having skin allergies and other co morbid conditions were excluded from the study. Selected patients were conveniently divided into 3 groups: Group A, Group B and Group C. Then patients were assessed for facial symmetry and facial muscle function with Sunnybrook Facial Grading scale (SFGS) and Facial Disability Index-Physical Function, Social Function (FDI-PF, SF) respectively. Group A received Proprioceptive Neuromuscular Facilitation, Electrical Muscle Stimulation and Conventional Therapy. Group B received Kinesiology taping, Electrical Muscle Stimulation and Conventional Therapy. Group C received Electrical Muscle Stimulation and Conventional Therapy. Pre and post assessment was done at 0 and 6<sup>th</sup> week.

**Outcome measures:** These included Facial Disability Index-Physical Function and Social Function and Sunnybrook Facial Grading Scale for pre and post test measures.

### Interventions:

#### 1) Proprioceptive Neuromuscular Facilitation<sup>10-12</sup>

It was performed by Physical therapist. Therapist uses tips of the fingers as manual contact. It was performed on both the sides of the face. Facial muscles were reinforced by Rhythmic Initiation, repeated contraction, and irradiation principle was utilized to facilitate the contraction of weaker muscles. Stronger motions were resisted in order to stimulate and reinforce weaker motions. Each exercise was

performed 15 times in sets of 2 for 5 days per week for 6 consecutive weeks.

#### 2) Kinesiology Taping<sup>13</sup>

Kinesiology taping was applied using three I shaped KT strips, 2.5 cm wide. The longer strip was applied with 25% tension over the preauricular facial nerve area, and the ends were applied without tension towards the temporal and mandibular branches of facial nerve. One of the shorter strips was applied with a 50% upward stretch from the affected corner of the mouth. Other shorter strip was applied with 50% stretch along the zygomatic branch. The tape stayed in contact with the skin for 2 days. This application was repeated on third day and new tape was applied also remained in place for two more days. So, it was done twice a week for 6 consecutive weeks.

#### 3) Electrical stimulation<sup>10,14</sup>

It was applied to the each of the 8 facial muscles (frontalis, corrugator supercilli, palpebral part of orbicularis oculi, orbicularis oris, procerus, mentalis, buccinator, rissorius, and nasalis). Galvanic current of pulse duration 100ms was used to stimulate facial muscles and each muscle received 30 minimal contractions. Whereas nerve trunk received 10 contractions using faradic current of pulse duration 0.3ms, 5 days a week for 6 consecutive weeks.

#### 4) Conventional exercises<sup>10</sup>

It was done in front of the mirror to make patients visualize the movement on the non-affected side and recreate the same action on the affected side. Each exercise was performed 15 times in sets of 2 for 5 days per week for 6 consecutive weeks.

### Statistical Analysis

Standard descriptive statistics (mean, standard deviation) were analyzed for directly measured variables of patients using SPSS (Statistical Package for Social Sciences) version 18. Paired t-test was used for, within group differences and ANOVA was used for between group differences of the variable and Tukey's methods for used for pair wise comparison.

## 3. Results

**Table 1.1:** Comparison of the mean and standard deviation of Facial Disability Index-Physical Function and Social Function [FDI-PF, SF] scores in Bell's palsy Patients: 0 week and 6 weeks post treatment with in group A

Group A	FDI-PF Score		FDI-SF Score	
	Within Group	Within Group	Pre	Post
	Pre	Post	Pre	Post
Mean	45.71	58.57	49.14	72.57
S.D.	7.868	8.997	11.48	7.45
Number	7	7	7	7
Maximum	55	70	64	80
Minimum	35	45	32	60
Range	20	25	32	20
Mean Difference	12.86		23.43	
T Paired Test	12.728		11.52	
P value	<0.001		<0.001	
Table Value at 0.05	2.45		2.45	
Result	Significant		Significant	

**Table 1.2:** Comparison of the mean and standard deviation of Facial Disability Index-Physical Function and Social Function [FDI-PF, SF] scores in Bell’s palsy Patients: 0 week and 6 weeks post treatment with in group B

Group B	FDI-PF Score		FDI-SF Score	
	Within		Within	
	Pre	Post	Pre	Post
Mean	45.00	82.14	48.57	88.00
S.D.	7.071	5.669	13.551	4.619
Number	7	7	7	7
Maximum	55	90	68	92
Minimum	35	75	28	80
Range	20	15	40	12
Mean Difference	37.14		39.43	

T Paired Test	17.334	10.82
P value	<0.001	<0.001
Table Value at 0.05	2.45	2.45
Result	Significant	Significant

**Table 1.3:** Comparison of the mean and standard deviation of Facial Disability Index-Physical Function and Social Function [FDI-PF, SF] scores in Bell’s palsy Patients: 0 week and 6 weeks post treatment with in group C

Group C	FDI-PF Score		FDI-SF Score	
	Within		Within	
	Pre	Post	Pre	Post
Mean	44.29	53.57	48.00	61.71
S.D.	9.759	10.293	9.238	9.196
Number	7	7	7	7
Maximum	60	70	60	72
Minimum	35	45	36	48
Range	25	25	24	24
Mean Difference	9.29		13.71	
T Paired Test	13.000		16.971	
P value	<0.001		<0.001	
Table Value at 0.05	2.45		2.45	
Result	Significant		Significant	

**Table 1.4:** Comparison of the mean and standard deviation of Sunnybrook Facial Grading Scale scores in Bell’s palsy Patients: 0 week and 6 weeks post treatment with in group A

Group A	SFGS Score	
	Within	
	Pre	Post
Mean	26.86	59.14
S.D.	6.768	10.931

**Table 1.7:** Comparison of FDI-PF scores in Bell’s palsy patients: Pre and post treatment between group A,B and C

ANOVA	FDI-PF Score					
	PRE			POST		
	Group A	Group B	Group C	Group A	Group B	Group C
Mean	45.71	45.00	44.29	58.57	82.14	53.57
S.D.	7.868	7.071	9.759	8.997	5.669	10.293
Number	7	7	7	7	7	7
Maximum	55	55	60	70	90	70
Minimum	35	35	35	45	75	45
Range	20	20	25	25	15	25
F test	0.052			22.321		
Table Value at 0.05	3.493			3.493		
P value	0.949			<0.001		
Result	Not Significant			Significant		
Tukey’s method for Pairwise comparison	A v/s			A v/s		
Result with mean difference of Pair>	v/s B	0.72NSig	B v/s	v/s B	23.58Sig	B v/s
	v/s C	1.43NSig	0.72NSig	v/s C	5NSig	28.58Sig

Number	7	7
Maximum	37	76
Minimum	20	46
Range	17	30
Mean Difference	32.29	
T Paired Test	14.528	
P value	<0.001	
Table Value at 0.05	2.45	
Result	Significant	

**Table 1.5:** Comparison of the mean and standard deviation of Sunnybrook Facial Grading Scale scores in Bell’s palsy Patients: 0 week and 6 weeks post treatment with in group B

Group B	SFGS Score	
	Within	
	Pre	Post
Mean	26.29	75.14
S.D.	10.307	8.915
Number	7	7
Maximum	46	88
Minimum	17	60
Range	29	28
Mean Difference	48.86	
T Paired Test	25.445	
P value	<0.001	
Table Value at 0.05	2.45	
Result	Significant	

**Table 1.6:** Comparison of the mean and standard deviation of Sunnybrook Facial Grading Scale scores in Bell’s palsy Patients: 0 week and 6 weeks post treatment with in group C

Group C	SFGS Score	
	Within	
	Pre	Post
Mean	27.14	47.43
S.D.	8.435	9.778
Number	7	7
Maximum	37	59
Minimum	16	33
Range	21	26
Mean Difference	20.29	
T Paired Test	25.103	
P value	<0.001	
Table Value at 0.05	2.45	
Result	Significant	

**Table 1.8:** Comparison of FDI-SF scores in Bell’s palsy patients: Pre and post treatment between group A, B and C

ANOVA	FDI-SF Score					
	PRE			POST		
	Group A	Group B	Group C	Group A	Group B	Group C
Mean	49.14	48.57	48.00	72.57	88.00	61.71
S.D.	11.481	13.551	9.238	7.458	4.619	9.196
Number	7	7	7	7	7	7
Maximum	64	68	60	80	92	72
Minimum	32	28	36	60	80	48
Range	32	40	24	20	12	24
F test	0.017			22.684		
Table Value at 0.05	3.493			3.493		
P value	0.983			<0.001		
Result	Not Significant			Significant		
Tukey’s method for Pairwise comparison	A v/s			A v/s		
Result with mean difference of Pair>	v/s B	0.58NSig	B v/s	v/s B	15.43Sig	B v/s
	v/s C	1.15NSig	0.58NSig	v/s C	10.86Sig	26.29Sig

**Table 1.9:** Comparison of FDI-SF scores in Bell’s palsy patients: Pre and post treatment between group A,B and C

ANOVA	SFGS Score					
	PRE			POST		
	Group A	Group B	Group C	Group A	Group B	Group C
Mean	26.86	26.29	27.14	59.14	75.14	47.43
S.D.	6.768	10.307	8.435	10.931	8.915	9.778
Number	7	7	7	7	7	7
Maximum	37	46	37	76	88	59
Minimum	20	17	16	46	60	33
Range	17	29	21	30	28	26
F test	0.018			13.798		
Table Value at 0.05	3.493			3.493		
P value	0.982			<0.001		
Result	Not Significant			Significant		
Tukey’s method for Pairwise comparison	A v/s			A v/s		
Result with mean difference of Pair>	v/s B	0.58NSig	B v/s	v/s B	16Sig	B v/s
	v/s C	0.29NSig	0.86NSig	v/s C	11.72NSig	27.72Sig

#### 4. Discussion

According to the prognosis of Bell’s palsy, although approximately 70% of patients recover spontaneously, 15 to 20% experience slight cosmetic sequel and the remainder are left with moderate to severe sequel. Patients who are left with mild to moderate sequel have facial muscle dysfunction which is a disabling condition and has a dramatic effect on patient’s psychological well-being and quality of life. This emphasizes the importance of effective and safe treatment options that increase the recovery rate without sequel. In the present study all the patients of idiopathic Bell’s palsy were selected as per inclusion criteria out of 21 selected patients 10 were of right side Bell’s palsy and 11 were of left side Bell’s palsy and there mean age was found to be 43. Total numbers of males were 8 and on the other side number of females were 13. The aim of the study was to determine the efficacy of Proprioceptive Neuromuscular Facilitation (PNF) and Kinesiology Taping in patients with Bell’s palsy. As there were limited studies in the literature which showed the efficacy of Proprioceptive Neuromuscular Facilitation, Kinesiology Taping and Conventional Physiotherapy.

On comparing Group A, Group B and Group C, the analysis of Facial disability index –PF and SF (FDI-PF,SF) and Sunnybrook facial grading scale (SFGS) values within the group shows that there is statistically significant change in the mean of FDI-PF,SF and SFGS values at the level which were taken for assessment. When analyzed from pre-

intervention to post-intervention group, the mean values for pre-intervention to post-intervention for FDI-PF,SF and SBFSGS came out to be statistically significant showing improvement in FDI-PF, SF and SBFSGS scores in all the three groups. Whereas on comparing Group A and B, the results demonstrated that the performance of Proprioceptive neuromuscular facilitation along with electrical muscle stimulation and Conventional Physiotherapy was less efficient in improving facial motor function and facial symmetry (FDI-PF, SF and SFGS scores) in patients with bell’s palsy at the end of six weeks than the performance of Kinesiology taping along with Electrical muscle stimulation and Conventional Physiotherapy. There was a higher statistically significant difference found in Group B as compared to Group A between pre and post treatment applied to patients with Bell’s palsy.

These similar results done by Dr.Tushar J.Palekar etal also shows that when kinesiology taping given along with facial exercises improves the facial muscle function and facial symmetry compared to Proprioceptive Neuromuscular Facilitation given along with facial exercises. Kinesiology taping is a type of dynamic taping which may assist or resist the movement. It prevents facial asymmetry, prevents over the pull of paralyzed muscle and reinforces muscle action in graded fashion. It maintains the muscles angle of pull hence by correcting the pathomechanics in the muscle<sup>1</sup>.

Dr. Parveen Pathan did a study to determine the effect of taping with Conventional Physiotherapy in patients with facial palsy: A cross sectional study. The study showed similar results that there was a significant improvement in facial asymmetry of patient's receiving taping technique along with Conventional Physiotherapy. Subjects showed better functional recovery in terms of facial symmetry and ability to perform functional activities such as chewing, balloon blowing and speech. Taping helped to retain paralyzed facial muscles by maintaining symmetry and facilitating paralyzed muscles thereby preventing over-activity of normal muscles and acts as a stabilizing mechanism by promoting desired symmetrical movement pattern that needs to be repetitively reinforced before learning the movement<sup>2</sup>.

However, on comparing Group A, which received Proprioceptive neuromuscular facilitation along with Electrical muscle stimulation and Conventional Physiotherapy with Group C which received Electrical muscle stimulation and Conventional Physiotherapy the results demonstrated that there was statistical significant difference between the scores of FDI-SF while there was no significant difference between FDI-PF and SBFSGS scores showing that there was a relative uniform improvement in facial motor function and facial symmetry.

Similarly, Tharani Gmoorthy et al observed in their study which was done to find the effectiveness of proprioceptive neuromuscular facilitation along with electrical stimulation in patients with Bell's palsy. The study found that PNF was effective in sharpening the mouth and submandibular region and might be useful for perioral muscles to adapt to the alteration following orthodontic treatment as PNF improves the facial muscle function by initiating the voluntary effort via proprioceptive stimulation. Both the groups group A and group B had shown improvements in facial muscle function and facial symmetry. However better improvements were seen in facial symmetry and facial muscle function among the group who received Proprioceptive Neuromuscular Facilitation along with electrical muscle stimulation<sup>3</sup>.

However, on comparing Group B which received Kinesiology taping, Electrical muscle stimulation and Conventional Physiotherapy with Group C which received only Electrical muscle stimulation and Conventional physiotherapy demonstrated that applying kinesiology tape, Electrical muscle stimulation and conventional physiotherapy was more efficient in improving facial muscle function and facial symmetry in Bell's palsy patients at the end of six weeks than giving only electrical muscle stimulation along with Conventional Physiotherapy alone. There was a higher statistically significant difference found in group B as compared to Group C between pre and post treatment applied to patients with Bell's palsy.

Similar study done by Jyoti Sharma et al, also shows that Kinesio taping is more effective over conventional treatment for functional retraining in subjects with Bell's palsy on comparing the efficacy of Kinesio taping versus Conventional Physiotherapy in Bell's palsy patients. As, Conventional Physiotherapy involving facial exercises along with Electrical muscle stimulation does not encourages

functional reeducation of correct movement patterns which is the most basic aspect of the therapeutic process and lay the necessary foundation for learning the selective patterns to improve motor function but on the flip side taping helps to retain paralyzed facial muscle by maintain the symmetry and facilitating paralyzed muscle, thereby preventing over activity of normal muscles and acts as a stabilizing mechanism by promoting desired symmetrical movement pattern that needs to be repetitively reinforced<sup>4</sup>.

## 5. Future Scope

- Further studies with large sample size are necessary to determine the best scheme of rehabilitation for Bell's palsy patients.
- Good response with Kinesiology Tape along with EMS and Conventional Physiotherapy indicates the large, randomized controlled studies for further evaluation of effectiveness of K Tape.
- Further studies can be conducted in patients with other neurological disorder such as in hemiplegic patients or head injury patients.
- Further studies can be done on patients with post surgical management of Bell's palsy.

## 6. Conclusion

The present study concludes that Kinesiology taping combined with Conventional physiotherapy and Electrical stimulation is more effective, safe and promising complementary therapy in management of facial muscle dysfunction and facial asymmetry in Bell's palsy patients. Further, Proprioceptive Neuromuscular Facilitation, and Conventional physiotherapy alone are also effective in treating the patients with Bell's palsy and showed relative improvement in facial muscle function and facial symmetry. Thus, Kinesiology taping, should be implemented in physiotherapy protocol of Bell's palsy patients, as it will be helpful in improving the facial muscle function and facial symmetry thus improving the physical and social function along with decreasing the facial disability and correcting the facial asymmetry of an individual suffering from Bell's palsy. Hence, for better protocol Kinesiology tape should be given along with Conventional physiotherapy.

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