Original Article

EFFECT OF HIGH FREQUENCY TENS VERSUS SHAM TENS ON SPASTIC PLANTAR FLEXORS IN CHILDREN WITH CEREBRAL PALSY

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ABSTRACT

Objective: To evaluate the Effect of high TENS with conventional therapy in comparison to sham TENS with conventional therapy on spasticity of plantar flexors in cerebral palsy children.
Design: Experimental trial.
Subjects: 34 patients, diagnosed as cerebral palsy were selected and randomly assigned in to two groups experimental group (n=18) and control group (n=16).
Method: Patients included in both the groups attend regular physiotherapy session. In addition to conventional therapy, patients in experimental group received high TENS (f=100hz, pulse width =0.1ms, intensity-according to individuals sensory threshold) to the spastic plantar flexors for 15 minutes ,once per a day, 6 days in week, for 4 week. In control group everything was same only intensity was not increased.
Results: Within group comparison of the variables was done with wilcoxon matched pair test and between group comparisons with mann-whitney U test. Experimental group showed statistically significant improvement in MAS score for plantar flexors at 5%level of significance then control group but not in D and E dimension of GMFM 88 and active ankle dorsiflexion ROM.
Conclusion: High TENS along with other conventional therapy is more effective than conventional therapy alone in reduction of spasticity of plantar flexors in cerebral palsy children.
KEYWORDS: Spasticity, Cerebral palsy, TENS (transcutaneous electrical nerve stimulation)

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BACKGROUND

Cerebral palsy (CP) describe a group of disorders of the development of movement and posture causing activity limitation that are attributed to non progressive disturbances that occurred in developing fetal or infant brain which includes motor disorders accompanied by disturbances of sensation, cognition, communication, perception and/or behaviour and/or by a seizure disorders.[1] Spastic cerebral palsy is the most commonest type of CP.[2]

Spasticity is noted as major impairment in spastic cerebral palsy which is characterized by velocity dependent increase in tonic stretch reflex with exaggerated tendon jerks.[3,4]

Spasticity may have both the positive and negative effects. Spasticity is helpful to maintain antigravity posture ,preserve muscle bulk, preserve bone density but its severity leads to restriction in growth of muscles and bone according to age, contracture, deformities, abnormal movement, abnormal posture, abnormal gait, pressure sore, pain and so it also increase energy consumption.[5,6,7,8]

Lower limb spasticity has adverse effect on sitting posture and this lead to an impairment in the stabilisation of column vertebralis.[9] plantar flexors spasticity is the primary problem that hampers standing and walking ability. [10] Equines is the most common foot deformity in spastic cerebral palsy.[11]

So, reduction of spasticity is only one of the many facets of the overall management of motor disorder of cerebral palsy. There are various pharmacological, surgical and physical therapy approaches for the treatment of the spasticity.

In the physical therapy different electrical stimulations are used to reduce spasticity.

TENS is most commonly used forms of electro analgesia which act on gate control theory. lately, it has been used to reduce spasticity in different neurological condition like cerebral palsy [5,12], multiple sclerosis[13], spinal cord injury [14,15] stroke[16, 17].

So, purpose of the present study was to find out the effect of high TENS on spastic plantar flexors in cerebral palsy.

MATERIALS AND METHODS

34 patients with cerebral palsy suited to the selection criteria were included in the study and randomly distributed in group A [N=18, mean age -5.36 $\pm$ 1.8 year] & group B [N=16, mean age -5.31 $\pm$ 0.9 year] .

Inclusion criteria: 1) age group >3year, 2) cerebral palsy patients having spastic plantar flexors, 3) able to follow 3 step command and cooperative, 4)GMFCS level 1-3. Exclusion criteria: 1) patients with sensory affection, 2) surgery done for plantar flexors, 3) botox injection to plantar flexors before 6 months.

Treatment procedure was explained to the patients and parents, informed consent was taken and were evaluated according to the proforma.

Before the staring of TENS therapy patients were given few familiarization session of high TENS. Minimum 10 days gap was kept between end of familiarisation session and beginning of study in order to avoid the carryover effect of protocol.

Both group received conventional therapy regularly which consisted 1] passive, active and assistive exercise 2] stretching exercise 3]balance training 5]gait training according to requirement of patients.

In experimental group [A], TENS was given in prone lying position. Skin of the calf area of affected lower extremity was cleaned with a spirit to reduce skin resistance before electrode placement. Two carbonised rubber electrodes were used to stimulate the area. Ultrasonic gel was applied to the electrode to increase conduciveness. Then the electrode were placed over posterior aspect of patients leg over the calf area linearly and fasten with Velcro straps. The frequency was set to 100 Hz with a pulse width of 0.1 ms. The intensity was raised up to the sensory threshold of patients. The patient were promptly advised to inform the therapist if they felt any discomfort during the treatment. High TENS was given to the plantar flexors for 15 minute continuously once per day, 6 days per week for a period of 4 week.

In control group [B] everything was same only intensity was not increased.

Outcomes were assessed pre and post to the whole treatment protocol of 4 week

- Plantar flexors spasticity assessed by modified ashworth scale.
- Active Ankle Dorsiflexion range of motion assessed by universal goniometer.
- Gross Motor function measure by D[standing] & E [walking, running, jumping]dimension of GMFM-88 scale.

RESULTS

Statistical analysis

Pre and post all three outcome measure

- Individually Within group A & group B were analysed by using Wilcoxon matched pair test.
- Between group A & group B were analysed by using Mann Whitney U test

The level of significance was set at 5%.

DISCUSSION

In this study experimental group showed statically significant difference in reduction of plantar flexors spasticity. [Table-1]

Gabbani et al suggested that conventional TENS activate sensory Ia afferent fibers switching on pre synaptic inhibition mechanisms leading too reduction in spasticity. [5] Potisk et al reported that a significant reduction in exaggerated stretch reflex activity and decreases resistive torque of calf muscles immediately after 45 minutes of high TENS in chronic hemiplegic patients. [16] Goulet et al in 1996 explain that high TENS stimulate low threshold afferent which project to gamma motor neuron and modify their excitability which leads to reduction in spasticity.It seems that alpha and gamma motor neurons are controlled by pathways largely independent of each other. This above explanations could be underlying mechanism of reduction of spasticity by using high TENS in present study. [15]

Interventions used in conventional therapy may also helpful in improvement of all 3 outcome measure within both of the groups [Table1,2]. In the present study group A [experimental] showed significant reduction in plantar flexor spasticity compare to group B [Control] which also explain that active TENS does not give placebo effect [Table-3].

Results also suggested not significant difference of active ankle dorsiflexion ROM in between groups may be because in this study interventions focused only on reduction of plantar flexor spasticity, not on facilitation of dorsiflexor strength but active joint ROM require both prope extensibility and simultaneous contractability of repected muscles.

Limitations of this study are unchecked independent effect of TENS, long term effect of intervention. Outcome measures are re liable but validity is not well established. Future study should be done with appropriate sample size, long term follow up & conjoin effect of high TENS to appropriate spastic muscles with simultaneous facilitation of opposite muscle group along with functional activity.

GROUP A				
	Pre	Post	W	P value
	Mean±SD	Mean±SD		
MAS score				
Right	1.96±0.36	1.17±0.35	105	0.0008
Left	1.81±0.25	1.15±0.23	120	0.0005
Comparing the difference in mean ±SD of MAS within group A was found to be significant				
ROM				
Right	7.07±2.58	12.43±3.2	-105	0.0009
Left	9.50±3.75	14.19±4.1	-136	0.0004
Comparing the difference in mean ±SD of dorsiflexion range of motion within group A was found to be significant				
GMFM-88				
GMFM-D	14±14.44	17.17±14.1	-153	0.0003
GMFM-E	23.78±26.7	27.56±26.2	-120	0.0007
Comparing the difference in mean ±SD of D & E dimension of GMFM-88 within group A was found to be significant				

Table- 1: Mean difference in MAS scale for plantar flexors, dorsiflexion range of motion, GMFM-88 within group A.

GROUP B				
	Pre	Post	W	P value
	Mean±SD	Mean±SD		
MAS score				
Right	1.63±0.22	1.26±0.25	66	0.0011
Left	1.57±0.33	1.25±0.33	36	0.006
Comparing the difference in mean ±SD of MAS within group B was found to be significant				
ROM				
Right	9.20±3.84	11.27±4.0	-105	0.0008
Left	10.21±4.3	12.29±4.6	-91	0.0014
Comparing the difference in mean ±SD of dorsiflexion range of motion within group B was found to be significant				
GMFM-88				
GMFM-D	15.3±8.31	18.06±8.6	-136	0.0004
GMFM-E	17.19±13.4	20.25±15.2	-120	0.0007
Comparing the difference in mean ±SD of D & E dimension of GMFM-88 within group B was found to be significant				

Table-2: Mean difference in MAS scale for plantar flexors, dorsiflexion range of motion, GMFM-88 within group B.

Table-3: Mean difference in MAS scale for plantar flexors ,dorsiflexion range of motion, GMFM-88 between group A& B.

GROUP A& B				
	Group A Mean±SD	Group B Mean±SD	U	P value
MAS score				
Right	0.79±026	0.37±0.22	33	0.0004
Left	0.67±0.30	0.29±0.26	47	0.0027
Comparing the difference in mean ±SD of MAS between group A &B was found to be significant				
ROM				
Right	5.36±1.34	2.06±0.70	0	<0.0001
Left	4.69±1.35	2.07±1.14	16	<0.0001
Comparing the difference in mean ±SD of dorsiflexion range of motion between group A &B was not found to be significant				
GMFM-88				
GMFM-D	3.35±1.93	2.68±1.45	111.5	0.38
GMFM-E	3.89±2.99	3.06±3.50	109	0.23
Comparing the difference in mean ±SD of D & E dimension of GMFM-88 between group A &B was not found to be significant				

CONCLUSION

The conclusion of the present study is that high TENS along with conventional therapy is more effective for the reduction of plantar flexor spasticity then conventional therapy alone in cerebral palsy children.

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