Significance of Electrical Stimulation in Conjunction with Ankle Foot Orthosis on Spasticity Control in Hemiplegic Children

Gehan H. El Meniawy
Department of Physical Therapy for Disturbance of Growth and Development in Children and its Surgery. Faculty of Physical Therapy, Cairo University.

ABSTRACT

The present study was conducted to determine the effects of faradic stimulation on the anterior tibial muscle group while wearing ankle foot orthosis, in conjunction with traditional physical therapy program, on controlling lower limb spasticity in hemiplegic cerebral palsy. ***Subjects:*** *Thirty hemiplegic cerebral palsied children (8 right side and 22 left side) ranging in age from six to eight years represented the sample of this study. They were selected from the out-patient clinic of the Faculty of Physical Therapy, Cairo University. The degree of spasticity ranged from mild to moderate grades according to the modified Ashworth scale. The lower limb was free from any structural deformities. Children were divided randomly into two groups of equal number A (control) and B (study).* ***Procedures:*** *Double blind evaluation was conducted to determine H/M ratio and degree of ankle excursion was conducted for each child of the two groups, before and after three months of treatment. Group A (control) received faradic stimulation on the anterior tibial group in addition to an exercise therapy program and wearing an ankle foot orthosis as a home routine, while group B (study) received faradic stimulation on the anterior tibial group while wearing the ankle foot orthosis in addition to the exercise program and home routine given to group A.* ***Results:*** *The results revealed, no significant differences when comparing the pre-treatment mean values of the two groups. Significant improvement was observed in all the measuring variables of the two groups (A and B), when comparing their pre and post-treatment mean values. Significant difference was also observed when comparing the post-treatment results of the two groups in favor of group B.* ***Discussion and Conclusion:*** *The significant difference recorded between the two groups in Hoffman reflex Myogenic response ratio and in ankle excursion may be attributed to the combined effects of faradic stimulation during wearing the ankle foot orthosis, in addition to the physical therapy program, in controlling spasticity of the affected lower limb and so, improving its functional*
Key words: *Faradic Stimulation, Ankle Foot Orthosis, Hemiplegic Cerebral Palsy.*

INTRODUCTION

Hemiplegic cerebral palsy composes a large portion of the pediatric physical therapist's case load[1].

Impairment in hemiplegia may include mal-alignments, contractures, deformities, insufficient force generation, abnormal muscle tone, abnormal tissue extensibility, exaggerated or hyperactive reflexes, poor selective control and regulation of activity in muscle groups and decreased ability to learn unique movement[2].

Loss of recruitment of agonist contraction or reduced out put paresis play a major role in impairment of muscle function[3].

Planter flexion deformity is a common finding in hemiplegic children, resulting from spasticity[4]. In such cases, increased motor neuron excitability has postulated to be a contributing factor in causing spasticity[5].This leads to excessive activity in muscle groups as wrist flexors and ankle planter flexors[6].

A general goal of physical therapy for children with hemiplegia is to decrease or inhibit the influence of abnormal muscle tone and reflex patterns, while simultaneously facilitate or stimulate the development of normal movement components[7].

A number of treatment modalities are used to improve function of cerebral palsied children[8].

Orthosis has been introduced as an effective method for correcting ankle planter flexion in those children. It is thought to be an effective approach because it may diminish hyper-reflexia and stretch connective tissues[9].

Various types of lower extremity orthosis have been used to correct equinus pattern in children with spastic cerebral palsy[10]. A solid ankle foot orthosis (AFO) has been the most commonly prescribed brace for reducing excessive planter flexion[11]. The rational for the design, purpose and use of the inhibitive AFO is proposed to be based on the inhibitive or reducing effect of casts[12].

It was established that the primary role of AFO is to change or enhance the biomechanics of the lower extremity. These biomechanical changes give an opportunity to enhance learning of motor skills which in turn result in functional improvement[13].

Application of orthosis in cerebral palsy has been indicated for preventing mal-alignment and contractures or correcting deformity, providing variable range of motion as needed and protecting weak muscles[14].

On the other hand electrical stimulation can be used increase muscle strength, motor control, range of motion, reduce abnormal muscle tone (spasticity) and improve function[15].

It has been reported that application of short width pulse stimulation in addition to neuro-developmental technique could help the hemiplegic children in deceasing spasticity and so, improving their functional abilities, compared to neuro-developmental technique alone[16].

This study is a trial conducted to investigate the effects of faradic stimulation on anterior tibial muscle group during wearing AFO in hemiplegic children.

SUBJECTS, INSTRUMENTATION AND PROCEDURES

Subjects

Thirty hemiplegic cerebral palsied children (8 right side and 22 left side), ranging in age from 6 to 8 years represented the sample of the study. They were selected from both sexes from the out patient clinic of the Faculty of Physical Therapy, Cairo University. They were free from any associated disorders other than spasticity, with minimal non significant perceptual defects, but they were able to follow instruction given to them. The degree of spasticity ranged from mild to moderate grade according to the modified Ashwroth scale[17]. The involved lower limb was free from any structural deformities; however children demonstrated variable degrees of tightness of hip adductors, hamstrings and tendo-Achillis muscles. Children were divided randomly into two groups of equal number (A and B). Double-blind evaluation to determine H/M and ankle excursion was conducted for each child individually before and after three months of treatment.

Group A (control) received faradic stimulation on the anterior tibial group in addition to an exercise therapy program and wearing an ankle foot orthoris as a home routine. Group B (study) received faradic stimulation on the anterior tibial group while wearing the ankle foot orthosis in addition to the exercise therapy program and home routine given to group A.

Instrumentation

I- For evaluation

1- A computerized electromygraphic apparatus (Diza 2380) was used to determine the Hoffman reflex Myogenic response (H/M) ratio.
2- Electrogeniometer was used to determine the degree of ankle excursion.

II- For treatment

1- Ankle foot orthosis (AFO) made of polypropylene that covers the entire calf and medio-lateral borders and sole of the foot, with straps across the anterior aspect of upper part of tibia and front of the ankle was used. The ankle foot orthosis is flexible, light weight and easily worn with regular shoes.
2- Faradic stimulator was used for anterior tibial group stimulation, (Phyaction 787) manufactured in Netherlands by Uniphy BV.
3- Tumble forms (mat, wedges, rollers and balls) from Preston for the application of the exercise program.

Procedures

I- For evaluation

Double blind evaluation for each child in the two groups was conducted in a warm, well lighted and quiet room, before and after three months of treatment using electromyography to measure H/M ratio, and electrogeniometer to measure the degree of ankle excursion.

1- H/M ratio

Surface electrodes were used for recording electromygraphic signals from soleus muscle. Tibial nerve in poplitial fossa was used for stimulation. The active electrode was placed two centimeters distal to the insertion of the gastrocnemius muscle, and the reference electrode was placed three centimeters distal to the active electrode[18,19]
Maximum Hoffman reflex and maximum gynogenic responses were recorded and H/M ratio was calculated to measure the motor neuron pool excitability which reflects the level of spasticity as an indication of central nervous system excitability[20].

2- Ankle excursion

From supine lying position with the foot outside the plinth and the knee slightly flexed, the fixed arm of the electrogeniometer was placed on the lateral aspect of the leg and the movable arm parallel to the lateral aspect of the foot. These arms were fastened in position via straps. Each child was then asked to move the ankle from full planter flexion to full dorsi-flexion (ankle excursion) and the range of motion was determined.

II-For treatment

Group A (control) received faradic stimulation on the anterior tibial group in addition to an exercise therapy program and wearing an ankle foot orthosis as a home routine for 8 hours daily.

1- Faradic stimulation

From supine lying position two small electrodes covered with gel were placed and fastened with straps as follows:
One electrode was at the fibular head and the other at the anterior surface of the lower third of the lower leg. The apparatus was adjusted and the intensity was increased gradually until visible contraction was observed. Stimulation continued for thirty minutes with ratio 1: 2 (10 seconds stimulation and 20 seconds relaxation)

2- Exercise therapy program

It include neuro-developmental technique, proprioceptive training, facilitation of righting and equilibrium reactions, stretching exercises for the muscles liable to be tight, namely hip flexors, adductors, hamstrings and tendo-Achillis muscles. Strengthening exercises to the antagonistic groups of the spastic muscles and gait training in a close and open environment. Special attention was also given to the effected upper limb and uninvolved side.

Group B (study) received faradic stimulation on the anterior tibial group with the same technique used for control group, but while wearing the ankle foot orthosis to keep the ankle joint at right angle, in addition to the same exercises therapy program and home routine give to group A.

RESULTS

The raw data of the H/M ratio and degree of ankle excursion of the affected lower limb were statically treated to determine the mean and standard deviation of each measuring variable, for the two groups A and B, before and after three months of treatment. Student's t-test was then applied to examine the significance of treatment conducted for each group.

The obtained results in this study revealed no significant differences when comparing the pre- treatment mean values of the two groups. Significant improvement was observed in all the measuring variables of the two groups A and B, when comparing their pre and post treatment mean values. High significant improvement was observed in group B, when comparing its post treatment mean values with the post treatment mean values of group A.

As revealed from table (1) and figure (1), significant reduction was observed in the mean value of H/M ratio in the control group (A) at the end of treatment as compared with the corresponding mean value before treatment (P<0.01).

Also, table (1) and figure (1), showed a significant reduction in the mean value of H/M ratio in the study group (B) at the end of treatment as compared with the corresponding mean value before treatment (P<0.001).

Table (1): Pre and post-treatment mean values of H/M ratio (mV.) for groups A and B

	Group A (control)		Group B (study)	
	Pre	Post	Pre	Post
X`	0.715	0.614	0.737	0.471
± SD	± 0.012	± 0.035	± 0.013	± 0.014
t-test	2.937		3.246	
P-value	0 < 0.01		< 0.001	
Sig.	Significant		Significant	

X`: Mean SD: Standard deviation P-value: Level of significance Sig.: Significance

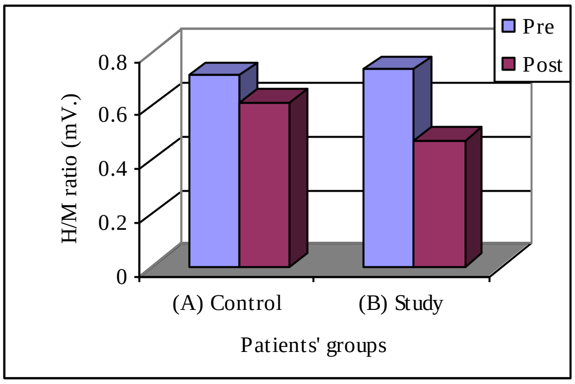

Fig. (1): Illustrating the pre and post-treatment mean values of H/M ratio (mV.) for groups A and B.

Significant improvement was also observed when comparing the post-treatment mean values of H/M ratio of the two groups in favor of group B (P<0.0001), Fig. (2).

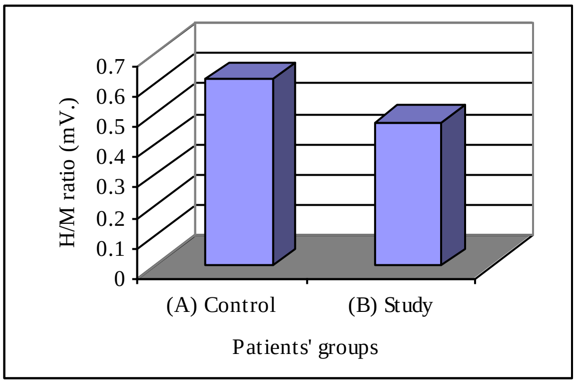

Fig. (2): Demonstrating the post-treatment mean values of H/M ratio (mV.) for groups A and B.

II- Degree of ankle excursion

As shown in table (2) and figure (3), significant increase was observed in the mean value of ankle excursion in the control group (A) at the end of treatment as compared with the corresponding mean value before treatment (P<0.01).

Also, table (2) and figure (3), revealed a significant increase in the mean value of ankle excursion in the study group (B) at the end of treatment as compared with the corresponding mean value before treatment (P<0.0001).

Table (2): Pre and post-treatment mean values of ankle excursion (degrees) for the two groups (A and B)

	Group A (control)		Group B (study)	
	Pre	Post	Pre	Post
X`	21.73	30.47	21.8	45.87
± SD	± 1.437	± 1.125	± 1.74	± 2.77
t-test	2.990		3.273	
P-value	0 < 0.01		< 0.001	
Sig.	Significant		Significant	

X`: Mean SD: Standard deviation P-value: Level of significance Sig.: Significance

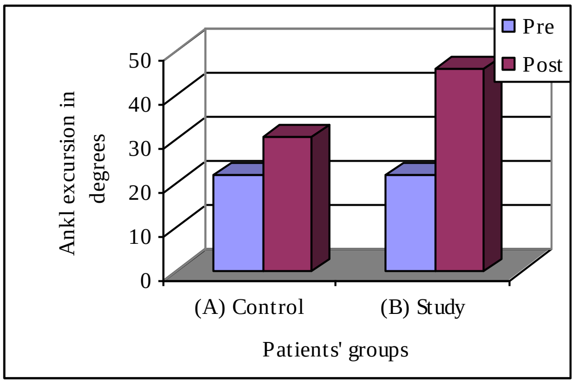

Fig. (3): Representing the pre and post-treatment mean values of ankle excursion (degree) for groups A and B.

Significant improvement was also observed when comparing the post-treatment mean values of ankle excursion of the two groups in favor of group B ($P<0.001$), Fig.(4).

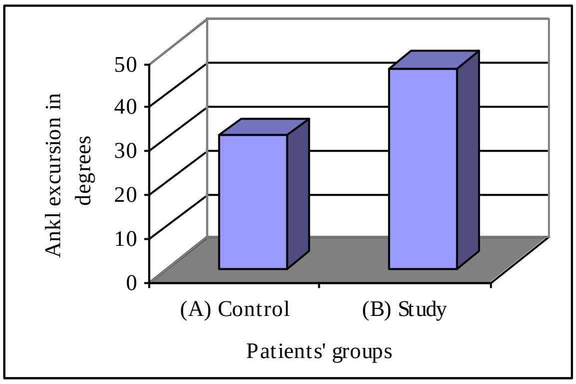

Fig. (4): Showing the post-treatment mean values of ankle excursion (degree) for groups A and B.

DISCUSSION

Functional limitations of the cerebral palsied children are mainly in mobility, balance and delay in acquiring motor milestones[14].

Walker and Stranger[21] emphasized that, the ability to maintain proper joint alignment of the lower extremity, and control the position of the foot in standing, is a critical treatment objective for the hemiplegic patients. For that reason AFO are frequently prescribed for hemiplegic children to provide appropriate biomechanical alignment for practice of a motor skill.

Statistical analysis of the post treatment results revealed significant improvement in H/M ratio and ankle excursion for the two groups A and B when comparing their pre and post treatment mean values. Highly significant improvement was noticed in favor of group B receiving electrical stimulation during wearing of AFO, in addition to the exercise therapy program, when comparing its post treatment results with the post treatment results of group A.

These results revealed the evidence of using electrical stimulation in conjunction with AFO in children with spastic cerebral palsy who demonstrate ankle planter flexion.

In the present study, faradic stimulation was applied on the anterior tibial group. This agrees with Garrett et al., [22] who reported that electrical stimulation produced better result than an exercise regimen alone. They revealed this to be due to recruitment of more motor units within stimulated muscle than by voluntary contraction alone.

Currier and Mann[23] established that electrical stimulation may influence cellular mechanism of the muscle, similar to the volitional contractile process, to produce adaptation of increased force.

Neuromuscular electrical stimulation has been well established as an effective adjunct to range of motion and stretching exercises, facilitation of muscle contraction and spasticity management programs used by the physical therapists[24].

Using faradic stimulation also agree with Powell et al.,[25], who reported an increase in the strength of wrist extensors after eight weeks of application of neuromuscular electrical stimulation in hemiplegic cerebral palsied children.

Fathi et al.,[26] concluded that neuromuscular electrical stimulation for the quadriceps and anterior tibial muscles is beneficial in controlling spasticity and improving gait pattern in hemiplegic cerebral palsy.

On the other hand, applying AFO as a home routine agree with Ohsawa et al.,[27] who developed a plastic ankle foot orthosis which can deal with severe spastic foot during walking. They revealed that electro-myogram studies showed that AFO reduced the spasticity in gastrocnemius and hamstrings and activated the quadriceps muscles.

Burtner et al.,[28] found decreased activation of gastrocnemius muscle and increased joint angular velocities at the knee when used AFO to correct skeletal mal-alignment in diplegic children.

Yankowitz [29] believed that foot orthosis are designed to provide an external correction for structural imbalance in the foot that may cause abnormal gait mechanics, affecting musculo-tendinous and ligamentous structures in the lower extremities, pelvis and lower back.

The results of the present study agree with Dursun et al.,[30] who evaluated the effectiveness of AFO on gait of spastic cerebral palsied children for whom orthosis were indicated to control dynamic equinus deformity. Their obtained results revealed that, the use of AFO during gait produced a statistically significant improvement in velocity and stride length.

Simultaneous use of faradic stimulation while wearing AFO, in group B, in addition to the physical therapy program demonstrated highly significant improvement. This combination gave a better chance to improve muscle tone, increase active range of ankle joint and strengthened the anterior tibial group via stimulating type II muscle fibers, so, improved the functional activities of the spastic lower limb muscles.

This improvement may be due to the effect of AFO which controlled spasticity via placing the ankle in a prolonged stretched position leading to inhibition or decrease of abnormal reflexes in the affected lower extremity by protecting the foot from tactile induced reflexes [31].

Inhibition caused by prolonged stretch via using AFO is thought to be a result of activation of Golgi tendon organs and joint receptors leading to autogenic inhibition of the stretched muscle groups. Spindle secondary endings may also be activated as they are more sensitive to absolute length changes.

It has been reported that AFO broke the extensor pattern of the lower limb by preventing excessive planter flexion, producing inhibition or dampening of muscle response and normalizing movements of the lower extremities, in addition, stimulating the anterior tibial group via faradic stimulation, facilitated its contraction which in turn reciprocally inhibited the posterior calf.

Keeping the ankle in stretched position via wearing ankle foot orthosis while application of faradic stimulation produce concentration of the stimulating current on the anti-spastic group of muscles and preventing its diffusion to the neighboring antagonistic group of muscles which may cause an undesired action.

Conclusion

From the results of the present study, it can be concluded that applying faradic stimulation while wearing AFO is an effective method for controlling lower limb spasticity and in turn improving functional abilities.

REFERENCES

1- Binder, H. and Eng, G.: Rehabilitation management of children with spastic diplegic cerebral palsy. Arch. Phys. Med. Rehab. 70: 481-489, 1989.

2- Olney, S. and Wright, M.: Cerebral palsy. In Campbell S., Vander D., Palisano R. (Eds.), Physical therapy for children. 2nd ed., W.B. Saunders, Philadelphia, 533-570, 2000.

3- Bohanon, R.: Assessment of strength deficits in eight paretic muscle groups of stroke patients. Phys. Ther. 67: 522-525, 1987.

4- Katz, M., Arbel, M. and Apter, M.: Early lengthening of Achilles tendon in children with spastic cerebral palsy. Amer. Orthop. Foot and Ankle Socie. 34(9): 698-712, 2000.

5- Anne, M., Wayne, A., Loretta, M. and Gregory, M.: Kinematic and electro-myographic characteristics of children with cerebral palsy who exhibit genu recurvatum. Arch. Phys. Rehab. 76: 1190-1202, 1995.

6- Bill, M. and Myers, P.: A series of case studies on the effect of a mid foot control ankle foot orthosis in the prevention of unresolved pressure area in children with cerebral palsy. Prosthetics and Orthotics Int., 25(3): 246-250, 2001.

7- Howison, M.: Occupational therapy with children. In Hopkins H., Smith H. (eds): Willard and Spackman's Occupation therapy 6th ed., Philadelphia, PA. J. B. Lippincott Co. 501-546, 1983.

8- Price, R., Bjornson, K. and Lehman, J.: Qualitative measurement of spasticity in children with cerebral palsy. Dev. Med. Child Neurol. 33: 533-585, 1991.

9- Carleson, W., Vaughan, C., Damiano, D. and Abel, M.: Orthotic management of gait in spastic diaplegia. Am, J. Phys. Med. Rehab. 76 (3): 219-225, 1997.

10- Knuston, L. and Clark, D.: Orthotic devices for ambulation in children with cerebral palsy and myelomeningiocele. Phys. Ther. 71: 947-960, 1991.

11- Butller, P. and Nene, A.: The biomechanics of fixed ankle foot orthosis and their potential in the management of cerebral palsied children. Physiotherapy. 77: 81-88, 1991.

12- Hylton, N.: Postural and functional impact of dynamic ankle-foot orthosis in a pediatric population. J. of Prosthetics, 2: 40-53, 1989.

13- Larin, H.: Motor learning: Theories and strategies for the practitioner. In: Campbell S., Vander Linder, D. and Palisano R. (eds.), Physical Therapy for Children, 2nd ed., W. B. Saunders, Philadelphia, 170-197, 2000.

14- Kott, K.: Orthosis for patients with neurological disorders. Clinical decision making. In: Seymour, r., (ed.), Prosthetics and Othotics: Lower limb and spinal. Lippincott Williams and Wilkins, London. 367-426, 2002.

15- Theresa, N.: Electrotherapy clinic procedure manual. 1st ed., McGraw-Hill. New York, 1-28, 2001.

16- Azzam, A., El-Negmy, E. and Salem, E.: Short width pulse stimulation in relation to spasticity control of hemiparetic cerebral palsied children, M. Sc. Thesis. Cairo University, Egypt.

17- Bohanon, R. and Smith, M.: Interrater reliability of a modified Ashworth scale of muscle spasticity. Physical Therapy, 67: 206-207, 1987.

18- Kahn, J.: Principles and practice of electrotherapy, 3rd ed., New York, Huntigton, 45-55, 1994.

19- Lamontagne, A., Malouin, F., Richard, C. and Dumas, F.: Evaluation of reflex and non-reflex induced muscle resistance to stretch in adults with spinal cord injury using hand held and isokinetic dynamometry. Phys. Ther., 78: 964-56, 1998.

20- Dimitrijeric, M.: Co-activation of ipsi- and contra-lateral muscle groups during contraction of ankle dorsiflexors.J. Neurol. Sci., 109: 49-55, 2000.

21- Walker, J. and Stranger, M.: Orthotic management. In: Dormans J. and Pellegrino L. (eds.), Caring for children with cerebral palsy:

A team approach. Paul. H. Brooks, Baltimore, 351-426, 1998.

22- Garrett, T., Laughman, R. and Youdas, J.: Strengthening brought about by a new Canadian muscle stimulator. A preliminary study. Phys. Ther., 60: 616, 1980.

23- Currier, D. and Mann, R.: Pain complaint: Comparison of electrical stimulation with conventional isometric exercise. J. Orthop. Sport Phys. Ther., 5(6): 318-323, 1984.

24- Lucinda, L. and Karen, P.: Neuromuscular electrical stimulation of the muscles surrounding the shoulder. Phys. Ther. 66: 12, 1986.

25- Powell, T., Pharoah, P., Cooke, R. and Rosenbloom, L.: Cerebral palsy in low birth weight infants – Dev. Med. Child Neurol., 36: 11-18, 1988.

26- Fathi, M., Mahmoud, M.T., Salem, E. and Khalil, S.: Neuromuscular electrical stimulation on calf muscle and medial hamstrings muscles versus anterior tibial and quadriceps muscles in hemiparetic cerebral palsied children. M. Sc., Thesis, Faculty of Physical Therapy, Cairo University, Egypt.

27- Ohsawa, S., Ikeda, S., Tanaka, S. and Takahash, T.: A new model of plastic ankle foot orthosis against spastic foot and genu-recurvatum. Prosthetics and Orthotics. 16 (2): 104-108, 1992.

28- Burtner, P., Woollacott, M. and Qualls, C.: Stance balance control with orthosis in a group of children with spastic cerebral palsy. Dev. Med. Child Neurol. 41(11): 548-557, 1999.

29- Yankowitz, G.: Examination of foot biomechanics in relation to sporting injuries and foot orthotic intervention. In: Seymour R. (ed.), Prosthetics and Orthotics: Lower limb and spinal. Lippincott Williams and Wilkins, London, 314-316, 2002.

30- Dursun, E., Dursun, N. and Alican, D.: Ankle foot orthosis: Effect on gait in children with cerebral palsy. Dis. Rehab., 24(7): 345-347, 2002.

31- Condia, D. and Meadows, C.: Ankle foot orthosis. In Bowker P., Conie D., Bader D., Pratt D., (eds.): Biomechanical basis of orthotic management. Oxford, United Kingdom: Butterworth Heinemann Ltd: 99-123, 1993.

الملخص العربى

الدلالة الإحصائية لتطبيق التنبيه الكهربائي أثناء ارتداء جبيرة مفصل القدم علي التحكم في النغمة العضلية لدي الأطفال المصابين بالفالج الشقي

أجريتْ هذه الدراسة لتحديدِ تأثير التنبيه الكهربائي باستخدام التيار الفرادى أثناء ارتداء جبيرة مفصل القدم ، بالإضافة إلى برنامجَ علاج طبيعي، وذلك للسَيْطَرَة على تشنج الطرفِ السفلي لدى الأطفال المصابين بالفالج الشقي. **عينة البحث**: اشتملت العينة علي ثلاثيْن طفلا مصابا بالفالج الشقي (ثمانية جانب أيمنِ و أثنى وعشرون جانبِ أيسرِ) ممن تَرَاوُحت أعْمارِهم مِنْ ستّة إلى ثمان سَنَواتِ. و قد تَراوحتْ درجة التشنج مِنْ بسيط إلي متوسط طَبقاً لمِقيا س أشورث المُعَدَّل. تم تقسيم الأطفال بشكل عشوائي إلى مجموعتين: المجموعة الضابطة (أ) ومجموعة إجراء موضوع البحث (ب). **طريقة البحث**: تم تقييم نسبة إتش / إم والمدى الحركي لمفصل الكاحل لكُلّ طفل بالمجموعتين، قَبلَ وَبَعد ثلاثة شهورِ مِن العلاج. تلقت المجموعة (أ) التنبيه الكهربائي بالاضافه إلي برنامج من التمرينات العلاجية و ارتداء جبيرة مفصل القدم كعلاج منزلِي طبيعيٍ، بينما تلقت المجموعة (ب) التنبيه الكهربائي أثناء ارتداء جبيرة مفصل القدم ، بالإضافة إلى برنامجَ العلاج الطبيعي الذي طبق عليَ المجموعة أ . **النَتائِج**: كَشفتْ النَتائِج انه لا يوجد اختلافات ذات دلالة إحصائية هامّةَ عن مقارنه قِيَم المتوسط الحسابيَ قَبْلَ المعالجةَ مِنْ المجموعتين. آما التحسن فقد لوحظَ في كُلّ متغيّراتِ قياس المجموعتين (أ) و(ب)، عندما مُقارنه قِيَمَهم قَبْلَ و بَعْد العلاج. ولوحظَ التحسن أيضاً عند مُقارنةُ نَتائِجَ ما بَعْدَ العلاج للمجموعتين لصالح مجموعة إجراء موضوع البحث. **المُناقشةِ**: التحسن الملحوظ الذي حدث في المجموعة(ب) بنسبة إتش / إم وقوة العضلات الأمامية للساق قَدْ يُنْسَبانِ إلى التأثيراتِ المشتركةِ للعلاج بالتنبيه الفرادى أثناء ارتداء جبيرة مفصل القدم، بالإضافة إلى برنامجَ العلاج الطبيعي ، في السَيْطَرَة على التشنج للطرفِ السفلي المصاب وهذا يُحسّنُ نشاطه الوظيفي.

الكلمات الدالة: التنبه الكهربائي، جبيرة مفصل القدم، الفالج الشقي لدي الأطفال.