Electrical Stimulation Versus Arm Splint In Improving Fine More Skills In Erb's Palsy Children

Abdel Aziz Ali Sherief
Department of Physical Therapy for Disturbance of Growth and Development in Children and its Surgery, Faculty of Physical Therapy, Cairo University

ABSTRACT

The purpose of this study was to compare the effect of using static splint and electrical stimulation on fine motor skills in Erb's palsy children. ***Method:*** *The study was conducted on thirty Erb's palsy children ranging in age from one to five months from both sexes. They were classified into two groups of equal numbers group (A) and group (B). Both groups received the same exercise program for one and half hour, three sessions per week for three successive months while using static splint in group A and electrical stimulation over the deltoid and the forearm muscles in group B. The subjects were evaluated and scored functionally, using the Toronto Active Motion Scale, and objectively, using an EMG device utilized to obtain the percentages of degeneration of muscles, at different time intervals; pretreatment and three months after the treatment program.* ***Results:*** *The results revealed statistical significant improvement in measuring variables of both groups when comparing their pre and post treatment mean values. Significant difference is obtained in favor of the study group (B) in comparison to group (A).* ***Conclusion:*** *the obtained results strongly supported the introduction of electrical stimulation of the deltoid and the forearm as muscles an additional procedure to the treatment program of Erb's palsied children.*

Key words: *Erb's palsy, ENoG, Electrical stimulation, hand, splint fine motor skills.*

INTRODUCTION

The brachial plexus is a network of nerves and is formed by the spinal nerves and roots of C5,6 (upper trunk), C8 and T1 (lower trunk) and sometimes with a contribution from C4 and T2 in pre and post fixed plexus respectively. Having divided into the upper, middle and lower trunk, these divisions divide further into the posterior, lateral and medical cords and then into supraclavicular and infralavicular branches[1]. Any injury can cause substantial functional impairment the brachial plexus may be injured by a high –energy trauma to the upper limb and neck region particularly where the head and neck are moved violently away from the ipsilateral shoulder. Injury can result in partial or complete paralysis of the upper limb, depending on whether all five roots or just the upper or lower roots are affected. The extent of the lesion will determine whether the paralysis is temporary or permanent but in all cases it will be devastating for the individual[2].

Erb's palsy results from stretching of the fifth and sixth cervical nerves. The infant's arm is held in "Waiter's tip" position, where the arm is extended and internally rotated and the wrist is flexed , When there is an absent Moro reflex in the right arm and the right hand grasp is intact Erb's palsy should be suspected[2].

Regardless of the incidence of spontaneous recovery and the transient quality of the paralysis in some patients. Contractures and deformities may occur rapidly. One should not await spontaneous recovery, as limitation of motion and deformity may persist, despite complete return of muscle power, if therapy is delayed[3].

An Erb's Engram develops in recovering Erb's palsied children limiting their upper extremity function. It's caused by an asymmetric injury at a time of rapid limb growth and an asymmetric reenervations of muscles causing muscle imbalances in the shoulder that will virtually lead to bone deformations[6].

Furthermore, scapular growth is impaired compared to the normal side. The patients exhibit a persistent elbow bent posture pronation position of the forearm and apparent shortening of the arm. In movement, there is loss of supination due to the abnormal situated arm in medial rotation, obvious elbow flare when the biceps is flexed, the "bugler's position" and awlward external rotation. This secondary structural shoulder deformity,

develops early and may persist despite improvement in neurological status[8].

SUBJECTS, MATERIALS AND PROCEDURES

Subjects

Thirty Erb's palsied children (from bath sexes) participated in this study with the following criteria:

-Their ages ranged from one to five months.
-EMG evidence of innervations interruption in the affected limb.
-Venue: the out-patient clinic of the faculty of Physical therapy, Cairo University.
-They were diagnosed with unilateral obstetric bracial plexys palsy involving C5-6.

Children were excluded if they had:

-Musculoskeletal or neurom-uscular abnoralitis other than Erb's plasy.
-Contractures or fixed limitations in the affected upper extremity.
-Hypersensitivity to latex and adhesive tapes.

The subjects were divided randomly into two groups of equal number (15 children in each group).

Group A (Control):

Received the designed physical therapy program for the treatment of Erb's Palsy.

Group B (Study):

Receive the same physical therapy pororgam designed for the control group in addition to electro stimulation to the affected muscles.

Materials

I-For evaluation:

A- Electroneurography: The device is a computerized electromyographic apparatus was used (Neriroscreen plus -4 channel – version 1.59 produced by TOENNIES. (Germany)

The EMG apparatus was used to detect the percentage of degeneration of the two muscles**:** the deltoid and the biceps brachii muscles.

B- Toronto Active Motion scale was used for motor functional assessment.

II- For treatment:

Physical therapy equipment's in form of hot packs, gymnastic mats, wedges, ball and rolls were used in conducting the traditional physical therapy program.

Procedures

For evaluation:

A-Physical evaluation:

1-A history was taken including obstetric history mode of delivery and postnatal health of the infant.

1- Clinically observed cyanosis or asymmetry of chest wall expansion indicates phernic nerve involvement and paralysis of the hemiodiaphragem.

2- Ocular asymmetry may be associated with Horner's syndrome (ptosis, miosis, enphthalmosis, and anhidrosis).

3- The passive range of movement of the involved arm, forearm, hand and shoulder was assessed.

4- The scapula was observed for wining and confirmed by measuring the distance between the spine and the lateral border of the scapula and compared by the unaffected side.

5- Muscle tone assessment (comparing, both sides) by palpation postural fixation، shaking, recoil fixation and passive movement.

6- Muscle strength was assessed by the Toronto Active motion scale. The muscles measured were the following:

- Shoulder flexors.
- Shoulder extensor.
- Shoulder abductor.
- Shoulder external rotators.
- Elbow flexors.

7- Sensory examination is difficult, although it is useful to obtain a reaction to painful stimuli, Pinrick sensation was the only thing tested. Cool dry skin may indicate the loss of sympathetic tone.

8- Long measurements (to detect shortness or lengthening) and round measurements (to detect shortness or lengthening) and round measurements (to detect atrophy) on both sides for comparison.

B-Electroneurography:

1-Setting up the childe for recording

The simulating and the recording sites were cleaned by rubbing the skin with alcohol. The procedure was repeated until the skin becomes slightly red to ensure the removal of

degenerated cells and lowering the skin resistance.

2-Position of the child during electrode placement and recording**:** the child was placed comfortably in a supine position on the examination table. The head of the child was maintained in mid position to avoid election of any primitive reflexes.

3-Preparation of the equipment:

-The apparatus was thoroughly checked for unattached or torn electrical wires or any sign of dampness due to liquid spillage.

-The software program was started and reset to zero.

-The patient's data were entered on the computer.

4-Electrode placement:

-Surface electrodes were used.

-For measuring the deltoid muscle action potential.

-The stimulating electrode was placed on the Erb's point.

-The earth electrode was placed below the lateral 1/3 of the clavicle.

-The Active recording electrode was placed on the motor point of the deltoid muscle.

-The reference recording electrode was placed farther distal on a relatively silent point.

For measuring the biceps muscle action potential.

-The stimulating electrode was placed on the Erb's point.

-The earth electrode was placed below the lateral 1/3 of the clavicle.

-The active recording electrode was placed on the motor point of the biceps muscle.

-The reference recording electrode was placed farther distal on a relatively silent point.

RESULTS

The results of pre and post treatment values were compared with each group. the results revealed significant improvement in both groups.

As presented in Table (1) and demonstrated in Figure (1) significant difference was recorded in the post treatment percentages of degeneration of the deltoid muscle for groups (A) and (B).

Table (1): Comparison of percentages of degeneration of the deltoid muscle between groups (A) and (B).

Percentage of degeneration of the deltoid muscle	Group (A)		Group (B)	
	Pre	Post	Pre	Post
Mean	68.8	41.9	71.36	20.52
+SD	±28.68	+27.05	±22.86	+21.09
t-value	27.3		50	
P-value	0.001		0.001	

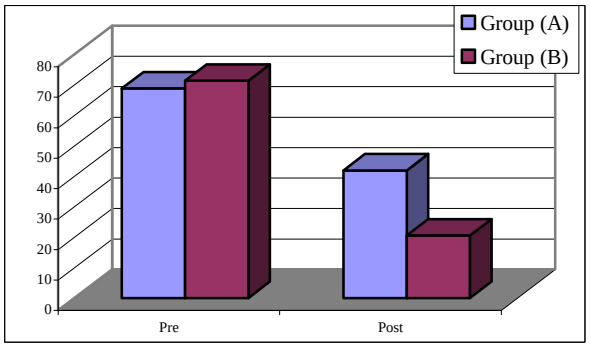

Fig. (1): Mean values of percentages of degeneration of the deltoid muscle between groups (A) and (B).

As presented in Table (2) and demonstrated in Figure (2), no significant difference was recorded in the post treatment percentages of degeneration of the biceps brachii muscle between the two groups.

Table (2): Comparison of percentages of degeneration of the biceps brachii muscle between groups (A) and (B).

Percentage of degeneration of the deltoid muscle	Group (A)		Group (B)	
	Pre	Post	Pre	Post
Mean	69.55	53.22	69.75	21.62
+SD	±32.35	±33.2	±19.24	±20.1
t-value	3.45		6.7	
P-value	0.001		0.001	

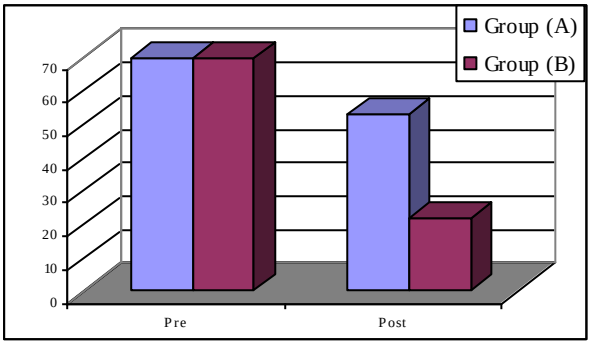

Fig. (2): Mean values of percentages of degeneration of the biceps brachii muscle between groups (A) and (B).

Shoulder flexion

As presented in table (4) and demonstrated in Figure (4) significant difference was recorded in the pre treatment grades of the TAMS recorded in shoulder flexion between groups (A) and (B).

Table (3): Comparison of TAMS in shoulder flexion between groups (A) and (B) pre and post–treatment.

TAMS grades in shoulder flexion	Group (A)		Group (B)	
	Pre	Post	Pre	Post
Mean	2.76	4.58	2.62	5.43
+SD	+2.31	+2.1	+2.0	+1.9
t-value	3.8		6.7	
P-value	0.001		0.001	

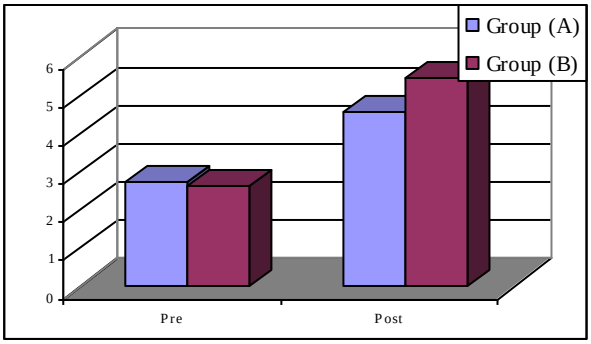

Fig. (3): Comparison of Mean values of TAMS in shoulder flexion between groups (A) and (B).

As presented in table (4) and demonstrated in Fig. (4) significant difference was recorded in the post treatment grades of the TAMS recorded in shoulder abduction for groups (A) and (B).

Table (4): Comparison of pre-treatment values of TAMS in shoulder abduction between groups (A) and (B).

TAMS grades in shoulder flexion	Group (A)		Group (B)	
	Pre	Post	Pre	Post
Mean	3.43	5.6	3.27	6.55
+SD	+2.3	+2.1	+1.5	+1.4
t-value	3.8		6.1	
P-value	0.001		0.001	

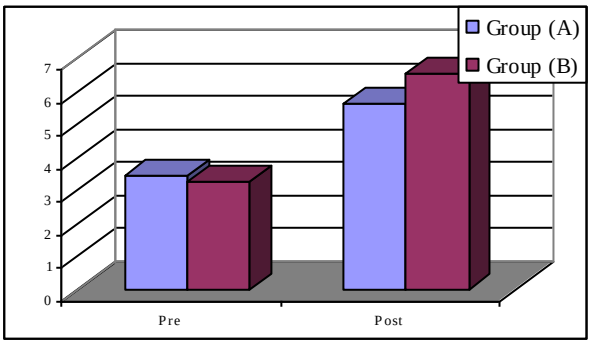

Fig. (4): Comparison of pre-treatment values of TAMS in shoulder abduction between groups (A) and (B).

As presented in table (5) and demonstrated in Fig. (5) significant difference was recoded in the post treatment grades of the TAMS recorded in shoulder external rotation for groups (A) and (B).

Table (5): Comparison of pre – treatment values of TAMS in shoulder external rotation between groups (A) and (B).

TAMS grades in shoulder flexion	Group (A)		Group (B)	
	Pre	Post	Pre	Post
Mean	2.22	5.2	2.55	6.77
+SD	+1.9	+1.8	+0.5	+0.4
t-value	7.5		16.5	
P-value	0.001		0.001	

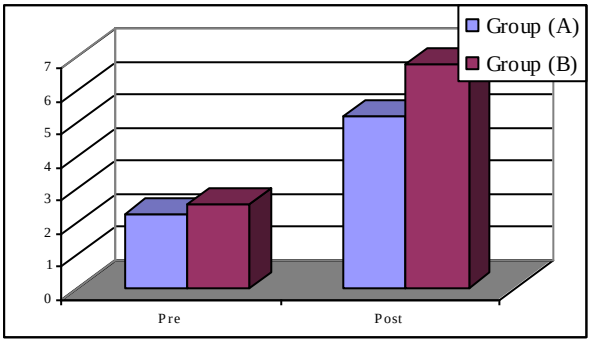

Fig. (5): Comparison of pre – treatment values of TAMS in shoulder external rotation between groups (A) and (B).

DISCUSSION

This present study provided the effect of applying electrical over the deltoid and the forearm together with a physical therapy. Program on the development of proper upper extremity function in recovering Erb's palsied children.

The aim of this research was to detect rapid functional improvement and percentages of of the most affected muscles.

For this purpose, thirty children of Erb's palsy were included in this study whose ages ranged from one to five months. The study was chosen to be done about Erb's palsy since, according to Math and piari who stated that Enb's palsy is the most common form of brachial plexus injury in the newborn affecting the C5 and C6 nerve roots Conshman and Diming Stated that the incidence of brachial plexus injury ranges from 0.13 to 3.6 per 1000 births and Erb's palsy accounts for approximately 90% of cases. While Edmonds.

Declared that the incidence has not declined over the past few decades but the prognosis for recovery has improved with full recovery expected in the majority of babies with Erb's palsy.

The age range was decided upon since starring therapy at an early age delays if not prevent further complications and deformities. As stated by Cuba, residual long-term deficits may include progressive bony defmorities, muscle atrophy joint contractures, Possible impaired growth of limb weakness of the shudder girdle and/or "Erb's Engram" (flexion of the elbow accompanied by abduction of shoulder). Therefore, correction of the supination deformity requires early intervention Marinio. Also according to Ogden, electrodiag-nostic examination should be deferred until at least three to four weeks after the injury to allow for abnormal spontaneous rest activity (Fibrillations and positive sharp waves) to develop in the setting of denervation and axon loss.

In addition early intervention and therapy is medically necessary to maintain supple joint motion and to prevent the development of contractures, where conservative management is beneficial for perverting muscle tightness and subsequent joint contracture when further neurological recovery is anticipated[10].

Children over five month were not included in this study giving that children without biceps function by six to nine months appear to have the most significant deformities later in life. The decision of whether to surgically repair the nerves however does typically need to be made in the first six months of life[14].

The children included in this study were evaluated functionally using the Toronto Active motion Scale which was suggested by who decleared that in the first three years of life he used the Toronto Scale because it is difficult to assess motion against resistance or measure the actual degree of motion in a reliable way.

Objective Electronuorographic evaluation was gained by a compulterized EMG apparatus utilized to obtain the percentages of degeneration of the deltoid and the biceps brachii muscles. Electroneurography has been chosen as a method of diagnosis and prognosis in this study since Grisham, confirmed that electrode-agnostic syidies help the location (root and / or plexus) extent and severity of the brachial plexus injury. The researchers stated that motor nerve conduction studies with measurement of the amplitude of the CAMPs in distal and proximal muscles provide usueful prognostic information. These CAMP amplitudes may be compared to the intact side to establish a percentage of degeneration.

These findings where opposed Nath, who stated that electrodiagnosis is often used to identify the level and extent of the lesion but there still remains controversy as to whether nerve conduction studies and needle electromyography typically performed at three months of age are helpful in predicting recovery or selecting patients for reconstruction.

The study group in this research received HVPG together with the designed physical therapy program. The HVPG taping idea is still rising in the medical field and it has numerous advantages over the functional system of the body[(21)]. Stated that as an adjunct to the therapeutic procedures can improve strength, functional activities, proprioception control and positioning.

Muscle and finishing at the muscle insertion general characteristics of both groups (A, B) from origin to insertion results in a concentric pull on the fascia during muscle contraction. This has the net effect on the muscle of enhancing or aiding the contraction.

The results of this study showed that the application of the general characteristics of both groups (A, B) alongside the designed physical therapy program in group (B) led to a signficaint increase in the active functional movements of shoulder flexion, abduction and external rotation, elbow flexion and radiolunar supination. In addition the percentages of degeneration of both the deltoid and the biceps muscles were considerably decreased in this group over group (A).

No significant differences were recorded between the two groups before starting application of the designed treatment program which implications the proper distribution of the patient samples in the two groups (A) and

(B). The non significances were recorded in the values of the ages, the percentages of degeneration of the deltoid muscle and the biceps brachii muscle and the TAMS.

The pre treatment mean grades of the TAMS in shoulder flexion, extension, abduction and external rotation, elbow flexion radioulnar supinatoin and wrist extension showed a decrease in their value which indicates that those children had weak active functions.

Conclusion

The obtained results strongly support the introduction of electrical stimulation of the deltoid and the forearm as an additional procedure to the treatment program of Erb's palsied children.

REFERENCE

1- Al Qattan, M.M.: An obstetric brachial plexus data sheet: journal of hand and microsourgery, 1(1): 32-38, 2009.
2- Alexander and Mathews, D.J.: Pediatric rehabilitation: principles and practice؛ 4th edition, demos Medical Publishing, 2010.
3- Anderson, J., Watt, J., Olson, J. and Van Aerde, J.: Perinatal brachial plexus palsy; Paediatr Child Health; 11(2): 93-100, 2006.
4- Cuba, D.K.: Guha's neonatology: Principles and practice: 3rd edition. Vol. 1 Jaypee Brothers publisher, 473, 2005.
5- Edmonds, K.: Dewhurst's Textbook of obstetrics and Gynaecology: 8th edition: John Wiley and Sons, 390, 2011.
6- Flannigan, C.: A practical Guide to Managing Paediatric Problems on the postnatal wards: Radcliff Publishing; 21, 2011.
7- Grisham, S.R. and Denning, L.M.: Pediatric life care planning and case management 2nd edition: Talor & Francis Group, 180: 520-521, 2001.
8- Gupte, S.: Recent advances in pediatrics 17 hot topics: Jaypee Brother medical publishers; 52-53, 2007.
9- Kulkarni, F.S.: Textbook of orthopedic and trauma; 2nd edition Jaypee Brother Medical Publisher; 3373, 2008.
10- Marino, B.S., Fine, K.S. and McMillan, J.A.: Blue prints Pediatrics 3rd edition, 163, 2004.
11- Mooney, M. and Ireson, C.: Occupational therapy in orthopedics and traum, 250, 2009.
12- Nath and Piazi, M.: Scapular deformity in obstetric brachial plexus palsy**:** A New Findings Surg Radiol Anta, 29: 133-140, 2007.
13- Nath, R.K.: Obstetric Brachial plexus injuries Erb's Palsy. The Nath Method of Diagnosis and Treatment. Texas Nerve and Paralysis Institute, 6-55, 2006.
14- Ogden, J.A.: Skeletal Injury in the Child, 3rd ed. Springer Verlag NY. Ine, 445, 2000.
15- Warren, R. and Arulkumaran, S.: Best practice in labour and delivery. Cambridge University Press, 100, 2009.

الملخص العربي

دراسة تأثير التنبيه الكهربائي على وظائف الدقيقة لليد للأطفال المصابين بمرض الإرب

الخلفية والهدف من الدراسة: ملخ الولادة (الإرب) هو مشكلة شائعة ومعيقة يتميز هذا المرض بالعديد من الأعراض ألا وهي عدم القدرة على الحركة واستخدام اليد والتأخر في جميع الأنشطة اليومية . الهدف من الدراسة: يهدف هذا البحث إلى دراسة تأثير التنبيه الكهربائي على وظائف الدقيقة لليد للأطفال المصابين بمرض الإرب . طريقة البحث: شملت الدراسة 30 طفلا مصابا بمرض الإرب تتراوح أعمارهم مابين شهر إلى خمسة أشهر و تم تقسيمهن عشوائيا إلى مجموعتين مجموعة مشاركة في التمارين ومجموعة غير مشاركة. كانت مدة برنامج ثلاثة أشهر (ثلاث جلسات في الأسبوع)، الجلسة لمدة 60 دقيقة تم استخدام مقياس جهاز رسم العضلات ومقياس وظائف اليد قبل وبعد الانتهاء من البرنامج (أي بعد ثلاثة أشهر) . نتائج الدراسة : أظهرت النتائج وجود تأثيرات ايجابية ذات دلالة إحصائية بين القياس قبل وبعد للمجموعة المشاركة في القدرة على استخدام اليد وعدم وجود فروق ذات دلالة إحصائية على كل من . الاستنتاج: استنتج من الدراسة أن هناك تأثير ايجابي للتنبيه الكهربائي على وظائف الدقيقة لليد للأطفال المصابين بمرض الإرب .