

Implication of Functional Electrical Stimulation on Upper Limb Recovery in A Rare Case of Adolescent Chronic Obstetric Brachial Plexus Injury: A Case Report

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ABSTRACT

Introduction:Chronic Obstetric Brachial Plexus Injury(COBPI) is the most common neurological birth injury causing paralysis of the upper extremity leading to hindrances in active movements and performing activities of daily living.

Purpose: To evaluate the effect of Functional Electrical stimulation (FES) for upper limb recovery in adolescent case of COBPI.

Method: The protocol of the study included application of FES Therapy for left upper limb for 30 minutes,6 days a week for a period of 4 weeks.

Result: Raimondi's Score for elbow and hand showed improvements in grades of functional movements with progression in shoulder range of motion and Mallet Scale.

Conclusion: The study concluded that application of FES therapy improves upper limb function in COBPI..

Keywords:

Obstetric brachial plexus injury, adolescent, functional electrical stimulation, upper extremity.

1.Introduction

Obstetric Brachial Plexus Injury is the most commonest neurological birth injury causing paralysis of the upper extremity due to injury to the primary nerves of the upper or/and middle trunk of brachial plexus. The extent of this injury ranges from 0.9 to 2.6 per 1000 births and considerable arm weakness of 4.5 to 5 in 10000 births. The numerous causes of Brachial Plexus Injury are; malfunctioned obstetrical technique, traction of neck of the fetus during delivery, breech delivery, vacuum and forceps delivery, maternal diabetes and obesity, huge fetal size, shoulder dystocia etc⁽¹⁾. It has the best prognosis of recovery yet 25% of affected population presents with varying degrees of contractures, limb length discrepancies, gleno humeral joint deformities dominating an individual's overall development ⁽²⁾. One of the evolved electrotherapeutic interventions used in improving upper extremity motor function is FES⁽³⁾. As , the threshold for eliciting an action potential in a muscle fibre at once is much higher than the threshold cost of inducing action potentials in a neuron, FES is used to stimulate nerves in order to activate corresponding muscles. This concept allows for successful movement in an affected extremity corresponding to extreme loss of muscle function^(2,3). Various studies found that FES is successful for improving upper limb functions such as reaching, holding, grasping, moving and releasing objects and increasing range of motion in various neurological conditions.⁽⁴⁾⁽⁵⁾ Therefore, we aimed to evaluate the effect of FES in left Upper Extremity in patient with COBPI.⁽⁶⁾

2. Case Description

A 15 year old adolescent male who came to MGM neurophysiotherapy OPD with complaint of difficulty in lifting left arm and difficulty in performing activities of daily living such as combing, reaching and picking up objects and transferring them. It was secondary to obstetric birth injury which resulted from prolonged labour of 18 hours and use of forceps as assistive device for vaginal delivery. He did not undergo any surgical intervention in the course of 15 years. Prior to study, patient's Motor recovery status of Upper Extremity was measured by Raimondi's scale for elbow and hand function, Mallet scale for shoulder and Range of motion by goniometer for Left upper limb .The written informed consent was obtained by the patient.

3. Intervention methods:

Functional Electrical Stimulation

FES therapy was given with MEGAXP electrical stimulator which was multichannel fully programmed FES system with surface electrodes used to deliver stimulation pulses secured on skin with adhesive tapes. The muscles that was stimulated are as follow: channel –I to shoulder abductors flexors and extensors , channel –II to elbow extensors and channel-III to stimulate wrist extensors. [Figure .1]The Muscles was stimulated with Symmetrical Biphasic pulsed current with pulse duration of 250 microseconds. The ramp-up and ramp-down period was for 2 seconds with frequency of 35 Htz.



Figure .1

Fes Therapy Protocol

The therapy includes preprogrammed coordinated muscular stimulation and Active assisted range of motion of upper limb to produce Functional movements. Patient performs following movements during FES therapy :1) reaching for a ball 2) grasping the ball 3) releasing the ball [Figure.2.]. Total treatment duration was 30 minutes per session for 6 days of a week for 4 weeks. Each task was performed 15 times during single treatment session.



Figure.2. a)Reaching for a ball. b) Grasping the ball. c)Releasing the ball.

4. Result

After 4 weeks of FES therapy, we found that FES therapy has positive effects on left upper limb motor recovery in COBPI. The patient showed improvement in AROM of Shoulder Flexion, and Abduction range of motion. Prior to therapy Mallet Scale score was 2 and post - therapy score improved to 3 and Raimondi's score for elbow changed from grade 2 to grade 3 and for hand grade 2 to grade 4 improving wrist extension . [TABLE NO.1].

Table No.1 .Pre-Post Outcome Measures For Upper Limb

Outcome Measures	Pre - Therapy	Post - Therapy	Difference
1.MALLET SCORE FOR SHOULDER	2	3	1
2.RAIMONDI SCORE FOR			
Elbow Function	2	3	1
Hand Function	2	4	2
3.AROM			
Shoulder Flexion	0°-40	0-50°	10°
Shoulder Extension	0°-10	0-10°	0°
Shoulder Abduction	0°-20	0-25°	5°
Medial.Rotation	0°-40°	0°-40°	0°
Lateral Rotation	0°17°	0°-17°	0°°
Elbow Flexion	35°-140°	35°-145 °	5°
Elbow Extension	140°-35°	140°-25°	10°
Forearm Supination	0°-40°	0°-50°	10°
Forearm Pronation	0°-70°	0°-70°	0°
Wrist Flexion	0°-70°	0°-70°	0°
Wrist Extension	0°	0°-10°	10°

5. Discussion

This present study assessed the effectiveness of FES for Left upper limb recovery in adolescent case of Chronic Obstetric Brachial Plexus Injury which showed improvement in score of Mallet scale, Raimondi scale and AROM of shoulder, elbow and hand.

A review was done by Sen Linet.al to analyse the advances of FES in treatment of peripheral nerve injuries. The study concluded that Great advances have been made in the treatment of peripheral nerve injuries and it can not only enhance the regeneration of injured peripheral nerve, but also prevent muscular atrophy. This study was parallel to our study.⁽⁷⁾

According to T Adam Thrasher.et al. application of FES therapy for a period of 12 to 16 weeks includes proximal muscle stimulation during reaching task and distal muscle stimulation during grasp and pinch tasks, improves hand function and minimizes upper extremity impairments during recovery of sub acute Stroke. This study coincides with our idea of administering FES for 4 weeks to a COBPI patient for improving reaching and grasping activities.⁽⁸⁾

Gad Alon.et.al concluded a study in which FES was combined with other developmental interventions for upper extremity in babies and childrens with neuromuscular and functional deficits caused by OBPI. The study concluded that FES can enhance recovery of muscle

strength, motor control, and functional use of the upper extremity in patients with OBPI. Thus we administered FES to an adolescent with COBPI.⁽⁹⁾

Limitation of the study: there was no follow up after the intervention.

6. Conclusion

The current study concluded that application of FES therapy improves upper limb Motor functions in a case of COBPI, which adds on to the future scope of such studies.

list of abbreviations -

COBPI -Chronic Obstetric Brachial Plexus Injury

FES -Functional Electrical Stimulation.

ROM -Range of motion.

AROM –Active Range of Motion

ADLs -Activities Of Daily living.

source of funding -None.

conflict of interest - The authors declare no conflict of interest.

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