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A subjective improvement of the child with obstetric brachial plexus injury upper extremity function by electrical stimulation and physical therapy

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Abstract:

Aim: The aim of the study is to assess how much children with obstetric brachial plexus injuries report feeling their upper extremity function has improved after receiving physical therapy and electrical stimulation for a duration of 12 weeks.

Background and purpose: The purpose of this research is that children who suffer from obstetric brachial plexus injury (OBPI) may experience severe functional deficits in their upper extremities. Due to the initial nerve damage, the injury may impair cutaneous sensations, upper limb mobility, and musculoskeletal problems such muscle imbalances and contractures may develop in the patients. By assessing how well physical therapy and electrical stimulation work together to improve upper limb function in kids with OBPI, the study seeks to address these problems.

Method: An efficient combination of physical therapy and electrical simulation aids in the subjective improvement of a child's upper extremity function after obstetric brachial plexus injury. After 12 weeks of treatment, evaluate the active range of motion, passive range of motion and active movement scale for the afflicted limb. The findings show that the AMS grade is 5 for wrist extension, shoulder abduction, and shoulder adduction, and grade 3 for shoulder external rotation and forearm supination.

Result: There were no problems while utilising it, and the electric current was well tolerated. After receiving treatment for twelve weeks, each child's upper limb function was altered in a special way.

Conclusion: The electrical stimulation along with weight-bearing workouts will enhance upper-limb functions in daily life.

Index Terms **- Physical therapy; obstetric brachial plexus injury; electrical stimulation; weight-bearing workouts; Erb's palsy.**

INTRODUCTION

Erb's-Duchenne paralysis is the most common kind of brachial plexus damage. The two main treatment options are physical therapy and surgery[[1]].The injury may tear, rip, or avulse the spinal cord's plexus roots. Injury to the brachial plexus affects cutaneous feelings and mobility of the upper limbs[[2]]. Depending on the severity of the accident, the paralysis may go away on its own over a period of months, entail rehabilitation therapy, or possibly require surgery [[3]]. Popular or established physiotherapy treatments include functional bracing, tactile stimulation, exercise therapy, and soft tissue manipulation. [[4]]. Obstetric brachial plexus injury (OBPI) patients frequently develop musculoskeletal issues as a result of the initial nerve damage. Muscle imbalances and contractures cause the SHEAR (Scapular Hypoplasia, Elevation, and Rotation) deformity, one of the common skeletal alterations affecting the shoulder [[5]].A thorough analysis found that patients with obstetric brachial palsy between the ages of 0 and 10 can benefit from physical therapy approaches such constraint-induced movement therapy,

electrotherapy, and the use of splints or orthotics to enhance upper limb performance [[6]].Both electro-stimulation and continuous active motion therapy (CIMT) are efficient methods for restoring muscle tone, range of motion, and strength in damaged muscles [[7]].Infants with PBP showed an increase in active mobility of the afflicted upper limb after completing reach training and FES. The electric current was well tolerated, and there were no issues while using it. Individual alterations in the way that infants' upper limbs functioned were the result of the intervention's six-week duration. The findings of this study point to the use of electrical stimulation as a training aid for newborns with PBP when using the afflicted upper limb[[8]]. To confirm the findings and clarify the advantages of electrotherapy for newborns with PBP, more research should be done[[9]].The purpose of the current study was to evaluate how children with obstetric brachial plexus injuries improved in their ability to use their upper limbs after receiving electrical stimulation and traditional physical therapy.

OBJECTIVES

The study's goals are to determine whether a 12-week physical therapy and electrical stimulation treatment plan may help children with obstetric brachial plexus injuries (OBPI) improve their upper extremity function. The purpose of the study is to evaluate the affected limb's active range of motion, passive range of motion, and active movement scale following the course of treatment. The study specifically aims to ascertain how the treatment affects forearm supination, shoulder adduction, shoulder abduction, external rotation of the shoulder, and wrist extension. The study also intends to look into the patients' acceptance and tolerance of the electric current utilized in the treatment. Understanding the children with OBPI's subjective improvement in upper limb function following the combination treatment is another goal of the study. Additionally, the study intends to investigate how electrical stimulation and weight-bearing exercises could improve upper-limb functions in day-to-day activities.

METHODS

The effectiveness of electrical stimulation and physical therapy in a 5-year-old child with a history of right obstetric brachial plexus damage was assessed using a single case study methodology. Phases of the trial lasted 12 weeks each. The individual used the active movement scale to record all aspects of their right upper limb function. After receiving treatment for erb's palsy, the patient will participate in the trial and be functional. Physical treatment is followed by five days of electrical stimulation (low frequency current) application, weight-bearing exercises, and functional activities. Weight-bearing positions include the quadruped position, side on elbow, and extended arm sitting. Forward and backward crawling is followed by functional training exercises including the Mariner's wheel, wrist rolls, and ladder climbing.

PROCEDURE

Data on the patient's chronological age, gestational age, weight, height, head size, and medical report were initially gathered. The affected limb's (right) passive and active range of motion in the shoulder, elbow, forearm, wrist, and fingers was assessed and recorded. Make a note of the affected limb's muscular shortening. To evaluate the function, muscle tone, and movement of the afflicted limb, an active movement scale is used. The grades for shoulder abduction, adduction, and external rotation are noted. Grade 2 represented for forearm supination and Grade 3 wrist flexion and extension and appropriate finger motions.

The child underwent three weekly examinations of the affected upper limb's active movement scale. Functional electrical stimulation, weight-bearing exercises, and functional training are all included in the regimen. The child underwent three weekly assessments of the active movement scale of the affected upper limb in order to determine the passive and active range of motion for the shoulder, elbow, forearm, wrist, and fingers of the affected limb (right). For a period of 12 weeks, the intervention entails using functional electrical stimulation in conjunction with weight-bearing exercises and functional training. One square electrode (Black lead) with a 3-cm diameter and another pen-type electrode (Red lead) were utilised for functional electrical stimulation.

We explain to the child at first that using electrical current may give a tingling feeling and that throughout intervention; the child's facial expressions will be observed in order to identify the discomfort. The frequency was changed to 10 pulses per second during treatment, and the strength was raised until a noticeable contraction was produced. It uses surged Faradic current. The muscles to be stimulated are the Deltoid (anterior, middle), Infraspinatus, Biceps, Brachioradialis, and wrist extensors. An active electrode should be put on the nape of the neck, followed by the use of a pen electrode to stimulate the motor points of the required muscles of the affected limb.For each muscle, 30 contractions were recorded. The entire procedure lasts 15 minutes. The on time was 5 seconds, while the ramp times were 2 seconds for the uphill and 2 seconds for the downhill the off time was 10 seconds.Electrical Stimulation, range-improvement exercises that involve weight bearing and functional training are then provided. Side on elbow on the affected side, sitting with the elbow extended, quadruped, and crawling forward and backward are all weight-bearing positions. Each task should take five minutes. Mariners wheel 20 times for each flexion and abduction activity, wrist roll, 10 times of ladder climbing (up and down), and overhead ball throwing for up to 5 minutes per day are functional activity training.

DISCUSSION

In this single case research, the effects of combined weight bearing, functional activity training, and FES on a kid with OBP have been examined[[10]].Results indicated that there has been improvement in upper limb movement, allowing one to resume typical activities. Unlike previous research, this experiment provided distinct therapies for FES and weight bearing exercise to children with OBP injuries. The results show that it is feasible to achieve subjective improvement with a weight-bearing rehabilitation course followed by FES.One of the study's shortcomings is that children who are frightened about receiving FES should not do it. Only subjects who understand the treatment plan, comply with obtaining FES, and cooperate with adhering to treatment schedules are eligible for treatment. One child served as the basis for the entire observation.

RESULTS

Assess the affected limb's active range of motion, passive range of motion, and active movement scale after 12 weeks of treatment. Results indicate that AMS grade is 5 for shoulder abduction, adduction, wrist extension, and grade 3 for shoulder

external rotation, and forearm supination. The range of motion (ROM) has increased in the wrist, forearm, and shoulder in both active and passive range.Table 1detailing the treatment protocol and results overview by each week

Table 1Weekly Treatment Protocol and Results Overview

S. No.	Week	Treatment Details	Exercises and Functional Training	Results
1	1	Introduction to tingling sensation, use of surged Faradic current, frequency set at 10 pulses per second.	Mariner's wheel (20x flexion/abduction), wrist roll, ladder climbing (10x), overhead ball throwing (5 mins/day).	Baseline ROM assessment; initiation of treatment.
2	2	Continued electrical stimulation; 30 contractions per muscle. Electrode on nape, pen electrode for motor points.	Weight-bearing: side on elbow, sitting with elbow extended, quadruped, crawling forward and backward.	Slight improvement in muscle response and ROM.
3	3	Increased contraction intensity, monitored discomfort, maintained 5s on, 2s ramp, 10s off timing.	Continued previous exercises; emphasis on consistency and technique.	Improved muscle contraction visibility; gradual ROM improvement.
4	4	Adjusted stimulation parameters as needed based on comfort and response.	Functional training reinforced with additional reps for each exercise.	Notable improvements in upper limb movement; increased endurance.
5	5	Ongoing evaluation of facial expressions for discomfort; maintained exercise intensity.	Weight-bearing and functional exercises maintained; introduced variations for increased difficulty.	Significant improvement in AMS grade; ROM improvement noted in wrist and shoulder.
6	6	Sustained 30 contractions per muscle; reinforced correct electrode placement and ramp times.	Continued all exercises, incorporating new challenges as tolerated.	Marked improvement in ROM and strength; preparation for advanced functional tasks.
7	7	Continued treatment with focus on optimal muscle response; monitored for any adverse reactions.	Advanced functional training with longer duration and higher intensity.	Increased muscle strength and endurance; further ROM gains observed.
8	8	Final week of intensive electrical stimulation; recorded final contraction data and compared with baseline.	Focused on maintaining improvements; introduced maintenance exercises for ongoing therapy.	Final AMS assessment: grade 5 (shoulder abduction, adduction, wrist extension), grade 3 (shoulder rotation).
9	9-12	Post-treatment monitoring for sustained results; occasional functional training sessions to ensure continued ROM and strength maintenance.	Light maintenance exercises and functional tasks as required sustaining improvements.	Overall improvement maintained; significant increase in ROM and functional abilities noted post-therapy.

CONCLUSION

The combined effects of the FES, weight bearing, and functional activity training enhanced the active mobility of the afflicted upper limb in Erb's palsy. The electric current was well tolerated, and there were no issues while using it. Twelve weeks of intervention led to unique modifications in each child's upper limb's functionality. The findings of this study imply that weight-bearing exercises combined with electrical stimulation will improve upper-limb functions in day-to-day life. To validate the results and clarify the advantages of electrotherapy in children with erb'palsy, more research should be done.

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