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Splints And a Task-Oriented Approach Improve Upper Extremity Function in Children with Spastic Quadriplegic Cerebral Palsy

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Abstract

To investigate the combined impact of splints andTask-Oriented Approach(TOA) on Upper Extremity(UE)skills in children with Motor learning and motor movement execution were both necessary for the development of upper extremity (UE) skills. The UEs' musculoskeletal stability was necessary for the execution of motor motions. Spasticity, a frequent issue in kids with cerebral palsy (CP), can hinder and limit participant ability and activity.In this study, we investigated how task-oriented approach (TOA) intervention and splints could benefit quadriplegic CP children with spastic upper limbs. To evaluate the combined impact of splints and TOA vs the individual effects of splints and TOA on UE's skills.Using a quasi-experimental design, 15 kids were chosen using inclusion and exclusion criteria and then randomly allocated to one of three groups, A, B, or C, each consisting of five kids. During the four-week intervention program, children in Group A received splints together with TOA, children in Group B received splints, and children in Group C received TOA. The results of the PDMS-2 Peabody Developmental Motor Scales 2nd edition, PDMS-2 standardized test evaluation were used to examine each kid one week before and immediately after the four-week intervention.The statistical findings showed that when the intervention was concentrated on TOA together with the usage of splint and the full groups were compared to each other, there is a significant observable improvement in UE's abilities function in children with spastic quadriplegic CP group A comparing to group B and group C children.This study found that the assumption of motor learning, which states that an adequate neuromotor system combined with repeated practice will develop motor skills, is true when the goal of a treatment plan for children with quadriplegic CP is to develop UE skills.

Keywords: Cerebral Palsy, Upper Extremity, Splint, Task Oriented Approach

1. Introduction

One of the most prevalent pediatric illnesses, cerebral palsy (CP) has a wide range of motor deficits that manifest early in life and are permanent and non-progressive in nature [1].More than 60% of kids with quadriplegic cerebral palsy have poor hand function; this is one of the best indicators of limitations in daily activities and participation restrictions, according to research [2].Overactive spastic muscles have a detrimental effect on bones, muscles, joints, and joints' ability to move freely [3]. This is especially problematic in growing youngsters.

Many other clinical symptoms and functional limitations, such as those affecting the gross motor and UE's functions, have been referred to as "spastic CP" [4]. Children with spastic cerebral palsy have difficulty controlling their movements and have ineffective gait patterns. Consequently, they move in large groups and have trouble executing certain tasks [5].Although there isn't much solid research to back up this strategy, splinting is a frequently used occupational therapy (OT) method in the treatment of children with neurological problems [6, 7]. Assisting joints in biomechanically ideal postures and preventing contracture by giving prolonged stretch are the goals of hand splints, which are intended to improve motor task performance [18].Higgins et al, has also reported that task orientated training significantly increase UE's function in stroke patients [19]. However, a few studies have reported the effects of task oriented approach on UE's function in children with spastic hemiplegic CP.

Patients with neurological problems can function better with the afflicted arm when using the task-oriented approach (TOA). [5, 8]. They advised additional methodologically sound studies evaluating the use of hand splints in conjunction with evidenced based practice (EBP)[9, 10]. As a result, this study looked at how splints and TOA affected children with quadriplegic CP's UE skills

2. Methodology

We chose a convenience sample of 15 quadriplegic CP subjects for the study using a Quasi-experimental design (Pre and Post experimental study); we determined our sample size based on the maximum number of subjects that our resources allowed in the time available for the research, 5 in each of the three parallel-design groups. (A, B, and C) and required four weeks of splint and TOA. The study was conducted at the SVNIRTAR's occupational therapy department in Odisha, India.

To estimate the prevalence of Splints and a task-oriented approach improve upper extremity function in children with spastic quadriplegic cerebral palsyin a community of school children, Previous studies tell us that prevalence should be somewhere around 3% [p =3], Precision (absolute) - We'd like the result to be within 3% of the true value, Confidence level = 95%

$$n = \frac{Z^2\, p\, [1-p]}{d^2}$$

$$n = \frac{(1.96)^2\ 0.03\ (0.97)}{[0.04]^2} = \frac{(3.84)*(0.029)}{0.0016} = \frac{0.11136}{0.0016} = 69.6 = 70$$

d = absolute precision = 0.04
p = expected prevalence in the population = 0.03
1-p = 1-0.03 = 0,97

$z_{(1-\alpha/2)}$ = 1.96 = value of the standard normal distributioncorresponding to a significance level of α(1.96 for a 2-sided test at the 0.05 level)

The age ranges included are 2 to 6 years. Spastic quadriplegic children with cerebral palsy, both young boys and girls, should adhere to the modified Ashworth scale of spasticity level 2 and lower. Excluded brief remarks Children who have a known cognitive delay or mental disability are not eligible, fixed contractures or abnormalities that would limit one's ability to move freely when doing a reaching duty recently undergone orthopedic hand surgery before to the trial to reduce spasticity, Significant neurological conditions such as seizures, vision problems, a child six months into the study who received neuropharmacological treatment.

2.1 Second Edition of the Peabody Developmental Motor Scales (PDMS-2)

The PDMS-2 tools for evaluating young children's gross and fine motor abilities. Fine motor quotient (FMQ); FMQ have two subtests, Grasping and visual motor integration, that measure UE's fine motor skills that emerge early in life. It aims to assess a child's motor development from birth to age five. Validity and reliability have been established via empirical study. There were 2.003 people in the normative sample, hailing from 46 states. The PDMS-2 is a tool that can be used by a range of professionals, including early interventionists, psychologists, OTs and PTs, to evaluate the motor skills of young children.

2.2 Procedure:

Children with spastic quadriplegic CP being treated in the paediatric unit of SVNIRTAR have been selected for this study. Parents' permission was sought before informing the patients about the trial. By using sequential sampling, the subjects were separated into three groups. To gather baseline data, PDMS-2 was introduced to all the participants in the Team A.The thumb in opposition and dorsal/volar cock-up splints with web space were administered to the subjects' added TOA activities. Initial testing involved the individuals wearing a splint for three hours in the morning, 3 hours in the afternoon, and all through the night. Over the course of 4 weeks, daylight hours were increased. Group B: Subjects were fitted with web-space dorsal/volar cock-up splints with the thumb opposition. For four weeks, five days a week, Group C's subject received task-oriented exercises to complete for 45 minutes each. Each subject kept getting conventional therapy obtained PDMS-2 FMQ score after 4 weeks.

3. Results

The Wil-Coxon sign test (non-Parametric test) was computed using SPSS version 21.00 to determine the improvement in UE's skills function within the groups. Whitney Mann the groups' levels of progress were compared using the U test.

Table: 1 shows the demographic data of all the study subjects

Category	Gender		Clients	Type of cerebral palsy	Mean age months	Range in months
	Male	Female				
Splint and Activity Group	4	1	5	Quadriplegic	48.5m	29m-72m
Splint Group	4	1	5	Quadriplegic	55.5 m	29m-72m

Activity Group	3	2	5	Quadriplegic	45m	29m-72m
Total	11(73.3%)	4(26.7%)	15			

More participants in males (73.3%) compared to female (26.7%) participants in this study. There is significance mean age months in the splint Group particularly Quadriplegic-cerebral palsy. In this revealed that mean age of splint and activity is 48.5 months, the average age of splint is 55.5 months is higher the previous one, activity have the arithmetic mean is 45 months is compared is lower than previous two groups.

Table: 2 Shows the mean values and Z-Test values of group-A (Splint Combined TOA)

Group-A-post- pretest	No	Mean Ranks	Sum of ranks	Z-Test	p-value
Negative ranks	0	0.00	0.00	2.032	0.042^{*}
Positive ranks	5	3.00	15.00		
Ties	0	-	-		
Total	5	-	-		

*-Statistical significance difference at 95% ($p < 0.05$).
The above results reveal that there is a significant improvement in UE's skill function. The z-value 1.96), p-value (0.042< 0.05). The current study finding the output of group-A having the Z-test values (2.032 > 1.96) having statistical significance based on the Z-values and based on the p-value (0.042 < 0.05) it is also show the significance of the analysis.

Table: 3 shows the mean values and Z-Test values of group B (Splint)

Group-Bpre-posttest	No	Mean Ranks	Sum of ranks	Z-Test	P-value
Negative ranks	0	0.00	0.00	1.826	0.068^{ns}
Positive ranks	4	2.50	10.00		
Ties	1	-	-		
Total	5	-	-		

^{ns}- not statistical significance difference at 95% ($p > 0.05$).The above results reveal that there is no statisticallysignificant improvement in UE's skills. The Z-value (1.826< 1.96), P-value (0.068> 0.05).

Table: 4 shows the mean values and Z values of group C (TOA)

Group C pre-post test	N	Mean Ranks	Sum of ranks	Z value	p-value
Negative ranks	0	0.00	0.00	1.826	0.068^{ns}
Positive ranks	4	2.50	10.00		
Ties	1				
Total	5				

^{ns}- not statistical significance difference at 95% ($p > 0.05$).

The above results reveal that there is no significant improvement in UE's skills. The z-values (1.826>1.96), P-value (0.068> 0.05).

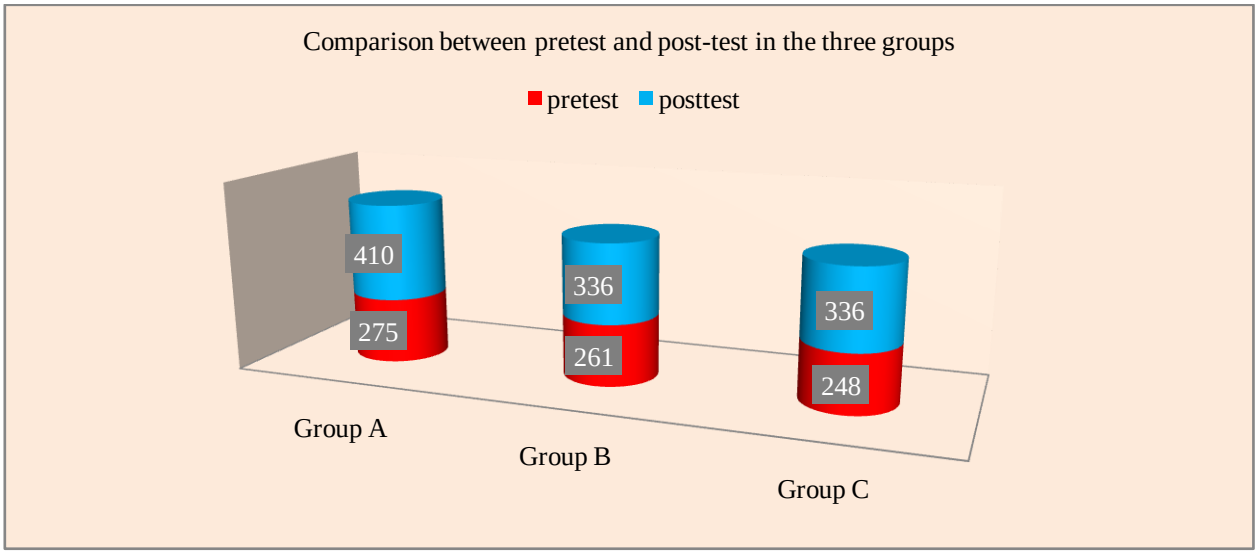

Figure1 shows the Pretest-Posttest FMQ mean differences in groups A, B, and C

Figure 1 reveal that Group-A average value (275) in the pre-test value is higher compare to Group-B average value (261) and Group-C average value (248), similarly Post-test value of Group-A average is (410) is higher than the other two groups

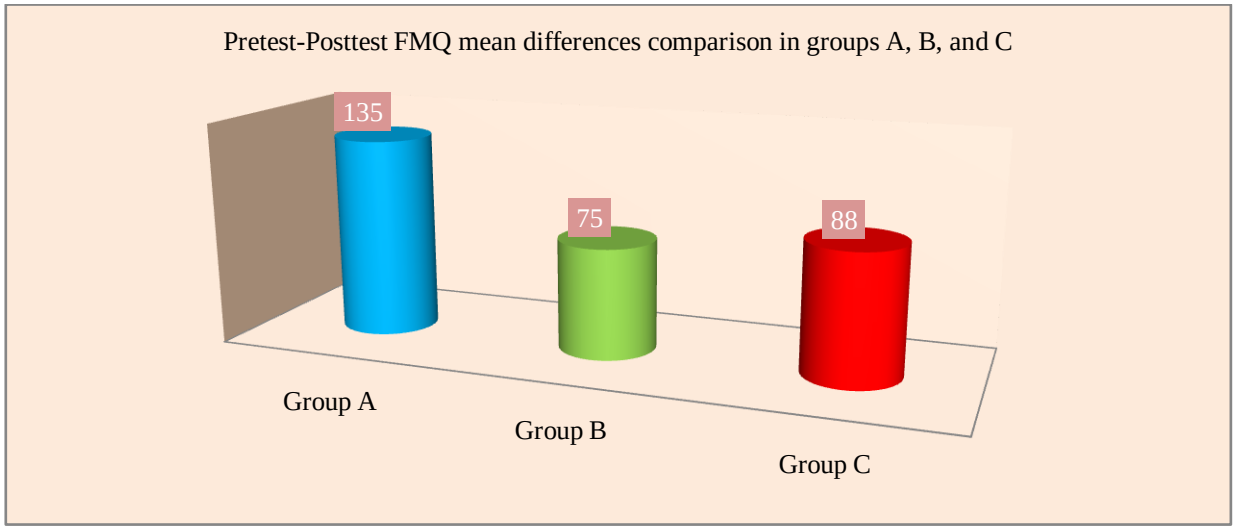

Figure 2 shows the Pretest-Posttest FMQ mean effect differences in groups A, B, and C.

Figure 2 reveal that Group-A mean difference between pre and post within Group-A, (135) is the difference of pre and post-test value is higher compare to Group-C pre and post mean difference (88) and Group-B pre and post mean difference (75). From the above figure depict the Group-A better groupcompare to other two groups based on the mean difference values.

4. Discussion

The goal of this study was to ascertain how the combined use of splints and TOA affected UE's ability to perform quadriplegic CP. The investigation proved that children with quadriplegic CP can

enhance their UE skills. In children with quadriplegic CP, a four-week therapy plan using a splint in conjunction with TOA has been shown to strengthen UE skills, according to an occupational therapy intervention program. Children with quadriplegic CP who combined splints and TOA performed better in group A compared to groups B and C; the children in group A improved their UE skills from 275 to 410; the score for group B splints improved from 261 to 336, and the score for group C TOA improved from 248 to 336; however, group A splint and TOA improved significantly more.

The PDMS-2 FMQ patients' pre- and post-test results showed a significant increase in the UE's skill function in addition to TOA therapies. As it is stressed, the intervention for UE's skill development is based on the system view of motor development [10].Both the neuromotor system and functional task activity will be considered. Because the combined effects of the two interventions will match the criteria for developing motor skills, individuals in group A were treated with a Splint and TOA discovered that children who received both a splint and goal-directed instruction improved their Goal Attainment Scale (GAS) scores more than children who only received goal-directed training [11].

The results of the data analysis of the FMQ pre- and post-test scores in a participant who wore splints revealed that there was no appreciable change in the user's ability. However, when the post-mean PDMS-2 FMQ score was compared to the mean of the pre-test score of PDMS-2 FMQ, the UE's skills in the splint group subject improved. The claim is corroborated by who concluded that splints aid in the reduction of spasticity and may have a minor positive impact on UE's abilities on the other hand, results decline after splints use is discontinued [12, 13 and 14].The results of the data analysis of the FMQ pre- and post-test scores in group C revealed that there has been no appreciable change in the UE's skill function. However, the UE performed better in the group-C subject when the post-test mean score of the PDMS-2 FMQ score were compared to the pre-test standard of the PDMS-2 FMQ score. The clinical intervention was found to be insufficient for achieving significant brain neuroplasticity and functional recovery in patients with neurological conditions [20].When the mean FMQ post-test score was compared to the FMQ pre-test score; there was a discernible improvement in upper extremity skills. According to goal-directed play helped young cerebral palsy patients with their basic motor skills and self-care [5, 8 and 15].

There were no discernible differences between Groups A and B, Groups B and C, or Groups A and C when all the groups were compared using the Mann-Whitney test. However, group A showed a noticeable improvement when the mean difference between the pre- and post-scores on the FMQ was contrasted to groups B and C.These results support those from Schulz. Dose, which identified the overall amount of practice as a crucial factor in task-specific training. According to earlier research, significant gains in UL function may take at least 40 hours of practice. Our study's practice dosage was far lower than this recommended minimal dosage, which is consistent with earlier task-specific training studies in the community of people with developmental coordination disorders [16].

5. Conclusion

We propose using splints in conjunction with TOA to help children with spastic quadriplegic CP improve their UE skills. When used in conjunction with EBP, splints are an effective therapy strategy. TOA could be used to implement motor learning techniques in order to enable UE functionality. Splints

can help prevent and correct erroneous movement in the non-neuronal and neuronal systems. The use of splints in conjunction with a task-oriented strategy may be beneficial in improving UE's developmental neurological disorder skill function. Intermediate Wearing splints for an extended period of time can make it easier to maintain the optimal functional position because it prevents muscle atrophy and increases desirable muscle group strength. More empirically validated research, especially on the use of splints, is required to determine whether this minor clinical effect results in significant gains for children with CP. A task-oriented approach must emphasize purposeful and skilled movement execution while encouraging patients' control or autonomy through task selection.

Clinical posture we propose using splints in conjunction with TOA to help children with spastic quadriplegic CP enhance their UE skills. Splints are a therapy strategy that is more effective when used in conjunction with EBP. TOA could be utilized to implement motor learning techniques in order to enable UE functionality. Splints can help prevent and correct erroneous movement in both non-neuronal and neuronal systems.

The combination of splints and a task-oriented strategy might be helpful to improved UE's skill function developmental neurological disorder. Intermediate Wearing splints for an extended period of time can make it simpler to maintain the optimal functional position because it prevents muscle atrophy and increases desirable muscle group strength. More methodologically sound research, particularly on the use of splints, is required to evaluate whether this tiny clinical effect results in considerable gains for children with CP. Task oriented approach must be emphasizepurpose full and skilled movement execution, encourage patients control or autonomy will be provided by choices of specific task to be practice.

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