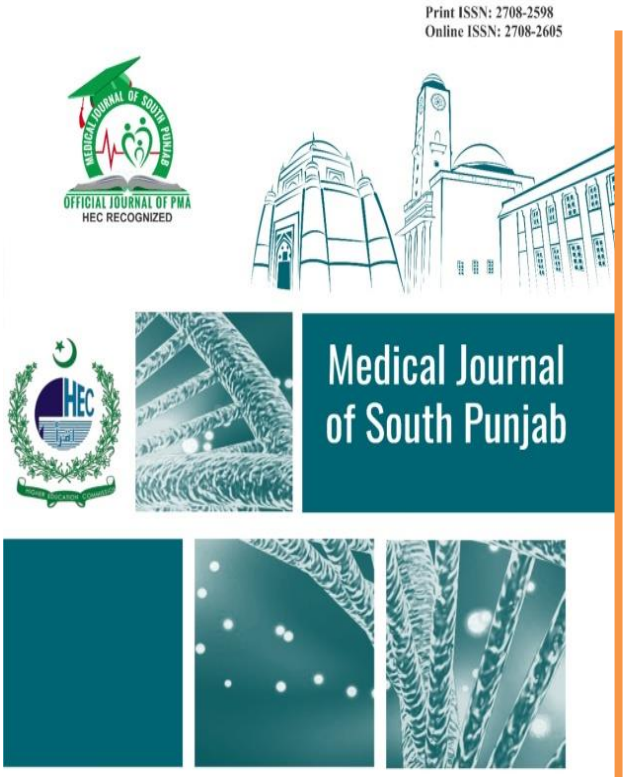
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Original Article

Comparison between effects of stretching exercises and task-oriented training on wrist flexors spasticity and upper limb function in children with spastic cerebral palsy

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ABSTRACT

Objective: To compare the effects of stretching exercises and task-oriented training on wrist flexor spasticity and upper-limb function in children with spastic cerebral palsy.

Methodology: This randomized controlled trial was conducted at Bakhtawar Amin Hospital from 2nd May, 2026 to 31st August, 2026. There were 60 children aged 4-8 years with spastic cerebral palsy and they were split into two groups. The stretching group (group A) and the task oriented group (group B). Both groups received four 30 minute sessions/week over a 6 week period. Upper-limb function and wrist flexor spasticity were evaluated by the Modified Ashworth Scale (MAS) and the Quality of Upper Extremity Skills Test (QUEST), respectively. Analysis of data was carried out using the IBM SPSS Statistics version 27.0. Wilcoxon signed ranked test and Mann-Whitney U-test were used.

Results: Both groups demonstrated statistically significant pre- and post-intervention changes in several outcome measures. Changes were seen in protective extension (p=.004), weight bearing (p<.001), dissociated movement (p<.001), overall QUEST score (p=.001) and MAS (p=.001) with no change seen in grasp (p=.570) in Group A. In all assessed outcomes group B results was a significant difference (p=.001). The post intervention differences between groups with respect to QUEST (p=.001) and MAS score (p=.031) were statistically significant. Group B's median after the intervention was lower than that of Goup A (1.00 compared to 2.00).

Conclusion: Task-oriented training showed a more positive post-intervention muscle tone of wrist flexors than the stretching intervention, and there was a between-group difference that was clinically significant in upper-limb functions.

Keywords: Cerebral palsy, Modified Ashworth Scale, Spasticity, Stretching exercises, Task-oriented training, Upper-limb function

1. INTRODUCTION

Cerebral palsy (CP) is a collection of permanent conditions, disorders or damages of movement, posture and motor function caused by non-progressive disturbances to the developing fetal or infant brain[1, 2]. It is among the most prevalent causes of childhood physical disability, and may have a profound impact on functional independence and participation in activities and daily life. Spastic cerebral palsy has many clinical manifestations, including increased muscle tone, hyper-reflexia or hyper-stretchability, and the inability to produce voluntary motor movements[3, 4]. Their involvement in the upper limbs is especially difficult as it will affect their ability to hold and let go of items and make movements. High muscle tone in flexors can make it hard to reach and open, and may interfere with functional activities like feeding, dressing, writing and playing[5, 6]. In addition, sometimes muscles remain stiff for extended periods which can lead to a decrease in joint mobility, further muscle shortening, and secondary musculoskeletal complications[7, 8]. Thus, the alleviation of upper-limb spasticity and enhancement of functional movement are important aims of paediatric rehabilitation.

Physiotherapy is an integral part of the management of motor impairments of spastic cerebral palsy. Stretching exercises are usually employed to enhance the extensibility of muscles, preserve normal ROM of the joints and to handle increased stiffness in the muscles. Regular stretching has been previously reported to enhance wrist mobility and to decrease wrist muscle stiffness[9, 10]. Stretching, however, is mainly used to increase flexibility in the muscles and may not be sufficient treatment for the functional limitations of motor coordination deficits. Task-oriented training focuses on practice of "real" goal-oriented activities with high repetitions and children develop motor skills by active participation and functional movements. The activities include reaching, grasping, releasing and manipulating objects, which enables task specific motor learning and coordination. Task-oriented interventions in children with cerebral palsy have been shown to be effective for improving upperlimb function in previous studies[11, 12]. Likewise, Wagdy et al. found hand function improvements to be higher in children who participated in task oriented training than other rehabilitation modalities[13]. However, both Stretching and Task-oriented training have shown promise and comparison study is an important study to be conducted.

Previous studies have been focused on the effect of stretching exercises and task-oriented rehabilitation individually, and few comparative evidence is available to assess the effects of these interventions on wrist flexor spasticity, functional performance of the upper limb in children with spastic cerebral palsy[8, 14]. Impact Of Progressive Strength And Functional Task-Oriented Training On Mobility And Gross Motor Function In Children With Spastic Cerebral Palsy: A Quasi-Experimental Study. Comparing both treatments based on standard outcome measurement, may lead to the identification of an optimal rehabilitation program. The Modified Ashworth Scale (MAS) is a clinical assessment of muscle tone and spasticity[15], while the Quality of Upper Extremity Skills Test (QUEST) is an assessment of various aspects of functional performance of the upper limbs[16], such as dissociated movement, grasp, protective extension and weight bearing. Thus the purpose of this study was to evaluate the difference between stretching exercises and task oriented training for the spasticity of wrist flexor muscles and upper limb function in children with spastic cerebral palsy. The study specifically examined the changes in scores for MAS and QUEST after six weeks of intervention, to identify which intervention which achieved better gains.

2. METHODOLOGY

The study used randomized controlled trial (RCT) to compare the effects of

interventions (stretching and task-oriented training), on wrist flexor spasticity and upper-limb function in children with spastic cerebral palsy. This study was carried out at Bakhtawar Amin Hospital between 2nd May 2026 to 31st August 2026 after the study was given the clearance of Synopsis. The intervention took place for six weeks. The number of children recruited was determined by G*Power software (effect size 0.5, significance level 0.10, power 0.60) to give 30 children in each group. Non-probability simple random sampling technique used for the recruiting eligible respondents for stretching exercise group (Group A) and task oriented training group (Group B). Children ages 4-8 years with spastic cerebral palsy, who would follow simple direction and engage in therapeutic activities, were included. Children were excluded if they had ataxic, dyskinetic, or mixed cerebral palsy, along with previous botulinum toxin injections within 6 months, previous surgery of the upper limbs, severe musculoskeletal deformities, fixed contractures, severe cognitive impairments, or uncontrolled seizures.

The modified Ashworth Scale (MAS) was used to assess wrist flexor spasticity, and the Quality of Upper Extremity Skills Test (QUEST) was used to assess function of the upper extremity, before and after the intervention. The wrist flexor stretching exercise was given to Group A and the task oriented exercise to Group B of the children which involved reaching, grasping, releasing and manipulating objects. Four hours of 30-minute sessions per week for six weeks were given to both groups. IBM SPSS Statistics 27.0 was used for analysis. Demographic data were summarized using descriptive statistics. The normality was evaluated by the Kolmogorov–Smirnov and Shapiro–Wilk tests. Within-group comparisons were performed using Wilcoxon signed-rank test; between-group comparisons were done using the Mann–Whitney U test. Results are presented as median (IQR) and mean rank.

3. RESULTS

All 60 participants were analysed. Descriptive statistics, normality tests, as well as within and between group comparisons were made. The data were not normally distributed so the Wilcoxon signed-rank test was utilized for comparisons within groups while the Mann–Whitney U test was used for comparisons between groups. A significance level of $p<.05$ was used. Both groups had significant deviations from normality for the Kolmogorov–Smirnov tests on QUEST and MAS scores ($p<.05$). Therefore, non-parametric tests were used for subsequent analyses. There were 30 children (4-8 years) in each group. There were no significant differences between groups in mean age (5.83 ± 1.44 years in Group A, 6.10 ± 1.52 years in Group B) or in mean gender coded value (1.47 ± 0.51 in both groups). Demographic data were compared with no missing data reported. The age distribution of the two groups. In Group A, children aged 4 and 5 years were most frequent (n=7; 23.3% each), followed by 7 years (n=6; 20%) and 6 and 8 years (n=5; 16.7% each). In Group B 6 children aged 7 years each had 7 participants (23.3 %), and children aged 8 years had 7 participants (23.3 %), with 6-year-old and 4-year-old being the remaining 5 and 7 participants (16.7 % and 23.3 %), respectively. 13.3% of children (4) were 5 years. The gender distribution showed Boys were 53.3% of participants, while girls were 46.7% in both groups.

Within-Group Analysis of Group A

Table 1: Within-group analysis of group A (Wilcoxon signed-rank Test)

Variable	Assessment	Median (IQR) Pre	Median (IQR) Post	P-value
Protective Extension	Post vs. Pre	12.50	8.34	.004
Weight Bearing	Post vs. Pre	8.34	11.11	0.000
Grasp	Post vs. Pre	12.50	11.67	0.57
Dislocated	Post vs. Pre	5.21	8.34	0.000

Movement				
QUEST Score	Post vs. Pre	1.00	1.00	0.001
Modified Ashworth Scale	Post vs. Pre	1.25	2.00	0.001

The Wilcoxon signed-rank test showed statistically significant Group A pre- to post-intervention differences in protective extension (p=.004), weight bearing (p<.001), dislocated movement (p<.001), QUEST score (p<.001), and Modified Ashworth Scale (p<.001). In the case of Grasp, there was no statistically significant difference (p=.570). The QUEST score change should be interpreted as an improvement in upper-limb movement quality if the higher score reflects better performance. The median M.A.S. score, however, went up from 1.25 to 2.00 – this means that there was greater muscle tone – which is not a good thing. Immediate judgment should be made of the reported median and rank values based on the output data prior to final conclusions.

Wilcoxon signed rank pre- and post intervention group B scores. For all outcomes, there were statistically significant differences between the groups (p=.001 for all outcomes), with the Protective Extension group scoring the highest and the Dislocated Movement group scoring the lowest, in descending order. Median weight-bearing scores rose from 6.26 to 8.77, while median scores declined for the other scores, including protective extension (8.34 to 8.33), grasp (11.88 to 8.33), and dislocated motion (6.25 to 3.23).

Table 2:Within-group analysis of group A

Variable	Assessment	Median (IQR) Pre	Median (IQR) Post	P-Value
Protective Extension	Post vs. Pre	8.34	8.33	.001
Weight Bearing	Post vs. Pre	6.26	8.77	.001
Grasp	Post vs. Pre*	11.88	8.33	.001
Dislocated Movement	Post vs. Pre	6.25	3.23	.001
QUEST Score	Post vs. Pre	1.00	0.00	.001
Modified Ashworth Scale	Post vs. Pre	1.00	1.00	.001

Overall QUEST score went down from 1.00 to 0.00, and, there was no change in the median Modified Ashworth Scale score (1.00). In the results, statistically significant pre and post differences have been found across all outcomes in Group B.

A comparison of the baseline, QUEST scores in Group A (stretch exercises) and Group B (task based training) was assessed using the Mann–Whitney U test. There was no significant difference between the groups in the QUEST scores (p=.434) or Modified Ashworth Scale scores (p=.756).

Table 3: Between-group analysis of Pre-intervention

Variable	Assessment	Group	Median (IQR)	P-value
QUEST Score	Pre-intervention	Group A: Stretching Exercises	1.00	.434
		Group B: Task-Oriented Task	1.00	
Modified Ashworth Scale		Group A: Stretching Exercises	1.25	.756
		Group B: Task-Oriented Task	1.00	

The mean ranks for the QUEST scores were 28.93 for Group A and 32.07 for Group B, respectively and the medians were 1.00 in both groups. The mean rank and median scores for the Modified Ashworth Scale of the patients in Group A were 29.85 and 1.25, respectively, and 31.15 and 1.00, respectively, for the patients in Group B. The results suggest no difference between the two groups with regard to their initial scores of either measure.

The differences in results after the intervention in both groups (Group A: stretching exercises, Group B: task-oriented training). After this, a statistically significant difference was found with the t-test score (with p value of .001) and the mean rank was 19.80 in Group A while it was 41.20 in Group B.

Table 4: Between-group analysis of Post-intervention

Variable	Assessment	Group	Median (IQR)	P-value
QUEST Score	Post-intervention	Group A: Stretching Exercises	1.00	.001
		Group B: Task-Oriented Task	0.00	
Modified Ashworth Scale		Group A: Stretching Exercises	2.00	.031
		Group B: Task-Oriented Task	1.00	

Both groups had a median score of 1.00. Statistically significant differences was also noted for Modified Ashworth Scale (p = .031). The mean ranks for Group A were 35.05 and for Group B was 25.95 while for Group B the mean ranks were 1.00 and 2.00, respectively. The Modified Ashworth Scale's post-intervention scores yielded a more favourable result for Group B (task-oriented training), with a lower median score (1.00 vs. 2.00) and a decrease of 4 points, meaning that group B had a greater improvement in muscle tone. The difference between groups was also statistically significant for the QUEST score (p=.001) but not for any of the other scores.

4. DISCUSSION

The goal of the present study was to evaluate the effects of task-oriented training and a stretching exercise program on wrist flexor spasticity and upper-limb function in children with spastic cerebral palsy. Statistically significant improvements were achieved in a number of outcome measures after 6 weeks of intervention in both of the groups. There were significant differences in scores from the post-intervention QUEST (P=.001) and Modified Ashworth Scale (P=.031) between groups, in favor of task-oriented training. The results in this study indicate that upper-limb functional gains and controlling muscle tone in the wrist flexors is more likely to be achieved in rehabilitation programs with tasks than with stretching alone.

Demographic results indicated that groups had similar average ages (Group A: 5.83 ± 1.44 years and Group B: 6.10 ± 1.52 years, respectively), as well as average age distributions, and no statistically significant baseline differences were found in the results of QUEST (p=0.434) and MAS (p=0.756). This comparability suggests that the groups initially had broadly similar clinical features, offering grounds for interpreting differences in post-intervention features.

These functional improvements seen with the task-oriented training might be attributed to the repetitive, goal-oriented movements emphasized in this training. Stretching tends to concentrate on the length and flexibility of the muscles while task oriented exercises demand active recruitment of muscle, coordination and repetition of functional movement. This interpretation is in line with the study by Wagdy et al. which examined motor function and its alterations in group of children with unilateral cerebral palsy (UCP) following either task oriented training or mirror therapy with 60 children, comparing the two groups, task oriented group showed more improvement in motor hand function[13]. In the same way, Daliri et al. compared a fine motor training using a virtual reality to a conventional occupational therapy after which they concluded that the virtual reality fine motor training enhanced the subjects' fine motor performance and grip strength when compared to the conventional occupational therapy training[17]. The results corroborate the use of task-specific, functional activities for increasing children with cerebral palsy's upper-limb performance.

Individually, there were significant differences for protective extension (p=.004) in Group A. In addition, the effectiveness of active rehabilitation methods is also confirmed by the authors from Adiguzel et al. who found that proprioceptive neuromuscular facilitation (PNF) resulted in better gains in children with cerebral palsy (CP) for upper-extremity

functional skills, grip strength, and muscle strength[18]. Similarly, Srilakshmi et al. observed benefits on upper extremity functional outcome after task-oriented and proprioceptive neuromuscular facilitation with no inter-groups difference[19]. In addition, Burgess et al. concluded that both goal-directed and other active upper-limb interventions would be effective strategies to enhance hand function and functional goal attainment[20].

The results all suggested that task-oriented training resulted in a more positive effect on the post intervention measures for wrist flexor muscle tone, and may yield a more improved upper-limb functional performance than stretching exercises. Yet, there are some limitations to take into account such as the small sample size, short intervention time, and the lack of long-term follow-up. Larger samples and longer follow-up is recommended to determine eitherinterventions are effective over time.

5. CONCLUSION

Task-oriented training yielded a more advantageous post-training wrist flexor muscle tone outcome and a likely larger benefit of upper-limb function than stretching in children with spastic cerebral palsy. However, larger studies with longer follow-up are needed to confirm these findings and establish the long-term effectiveness of both interventions..

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