Impact of spasticity intervention on psychometric function and quality of life in children with cerebral palsy

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ABSTRACT

Background: Cerebral palsy (CP) is a non-progressive disruption in the growing fetal or infant brain that affect mobility, posture, and activity. Assessment of the impact of treatment modalities on the short and long term outcome in children with CP is an area of great interest to improve the management strategies in such children.

Objective: to evaluate the impact of spasticity intervention therapy on the psychometric function and quality of life (QoL) in children with CP.

Patient and Methods: The present study was interventional descriptive cross-sectional study. It was carried on 50 children with documented CP with spasticity. They were selected consecutively from outpatient pediatric neurology clinic of Al-Zahraa university hospital – Al-Azhar University during the period from September 2022 to April 2023. All included children were subjected to detailed history taking, complete physical examination, assessment of Gross Motor Functional Classification System (GMFCS), Assessment of spasticity severity grade using modified Ashworth scale, Vineland Adaptive Behavior Scale (VABSA) and Health-related QoL (HR-QoL) assessment using the Pediatric Quality of Life (PedSQL).

Results: All CP children received medication baclofen and physiotherapy. In addition 24 children received also botox injection (52%) and 4 children made surgery (8%) including selective dorsal rhizotomy (SDR) and orthopedic procedures (Tendon lengthening). There was statistically significant improved in GMFCS, PedSQL scale and VABSA score after than before intervention in spastic CP children.

Conclusion: Spasticity intervention therapy is associated with better outcomes on the psychometric function and quality of life in children with CP.

Keywords: Spasticity intervention, Psychometric function, Quality of life, Cerebral palsy.

INTRODUCTION

Cerebral palsy (CP) is an irreversible non-progressive disruption in the growing foetal or infant brain that affects mobility, posture, and activity. **(Sadowska M, et al., 2020)**

Lesions in the sensorimotor cortex and sub plate are occasionally concerned, with different motor and non-motor regions often affected too. Its actual cause is complicated and involves several factors, which include inadequate oxygenation, infections, traumas, and genetic factors. **(Basu AP, et al., 2015)**

Cerebral palsy has been considered a frequent cause of chronic disability, with global; prevalence ranges from 2 to 2.5 out of 1000 live births. Even though the main cerebral lesion isn't progressive, the disease is irreversible and most of the manifestations such as the musculoskeletal adverse events are acquired and progressive over time. **(Jan MM, et al., 2006)**

Cerebral palsy in children has been associated with an impairment of motor functions. In addition, the majority of children with CP complained of sensory, communicative, and intellectual impairments and could have complicated restrictions on their self-care functions. **(Raina P, et al., 2005)**

About 30% of CP children are extensively comprised and acquire difficulties with the usual daily activities, communications, movements, and their health, and are dependent on their caregivers for the majority of their requirements. Such situations have considerable and long-term impacts on the children as well as on their families. **(Narayanan UG, et al., 2008)**

Spasticity has been considered the commonest presentation of CP. The most frequent form is the spastic subtype, which represents 83 percent of overall CP cases. In addition, spasticity is present in around seventy percent of children with dyskinetic CP. Spasticity is often associated with diminished range of motion (ROM), diminished all motor functions, and/or pain. On the other hand, spasticity could, in addition enhance motor functions by compensating of muscle weakness. **(Hägglund G, et al., 2021)**

Spasticity could deteriorate health-related QoL (HR-QoL) via several mechanisms. Impairment in mobility, loss of self-dependence and the requirement of nursing care, and depressive manifestations could decrease the self-perceived state of health and QoL for both the child and his family. **(Roncoroni LP, et al., 2020)**

There are multiple approaches available to decrease spasticity such as: botulinum toxin-A therapy (BTX-A), SDR and intrathecal baclofen therapy (ITB). Assessment of the impact of treatment modalities on the outcomes in children with CP is an area of great interest to improve the management strategies in such children. **(Hägglund G, et al., 2021).**

Aim of study: To evaluate the impact of spasticity intervention therapy on the psychometric function and quality of life in children with cerebral palsy.

Patient and methods

This was an interventional descriptive cross-sectional study conducted on a total of 50 children with documented cerebral palsy with spasticity. They were selected consecutively from outpatient pediatric neurology clinic of Al-Zahraa university hospital – Al-Azhar University during the period from September 2022 to April 2023.

Ethical consideration:

1. An informed oral and written was obtained from all parents of both patients and control groups before getting them involved in the study.
2. The researcher explained the stages, the aims, the potential benefits and hazards of the study to all parents of the patients and control groups.
3. The patients had the right to withdraw from the study at any time without giving any reasons .
4. All the data of patients and findings of the study were confidential and the patients have the right to keep it.
5. Ethical approval was obtained from the ethics committee of the Pediatrics department at the faculty of medicine for girls at Al-Azhar University, with registration number.
6. The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.
7. FINANCIAL DISCLOSURE / FUNDING:
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Sample size calculation:

The sample size calculation was done by G*Power 3.1.9.2 (Universitat Kiel, Germany). According to a previous study [(1)], the mean ± SD of GMFCS was 2.38 ± 2.99 pre-intervention and 5.47 ± 4.91 post-intervention. The sample size was based on the following considerations: 0.843 effect size, 95% confidence limit, 80% power of the study, group ratio 1:1 and two cases were added to overcome dropout. Therefore, we will recruit 50 patients in this study

Inclusion criteria:

- Children with spastic cerebral palsy according to abnormal motor development that wasn't progressive coupled with the existence of abnormal neurologic features that localized the lesion to the brain.
- Male and female sex.
- Age 2 years to 16 years.

Exclusion criteria:

- Children with co-morbid sever chronic health problems that contraindicates the interventional therapy (renal, hepatic, respiratory or cardiac impairment).
- Children with chromosomal abnormality.
- Children with musculoskeletal congenital malformation.
- Children with other neurological disorders rather than cerebral palsy.

Methods:

All the selected cases were subjected to:

1. **Complete history taking:**
   - Detailed perinatal and developmental history. Review neurological manifestation, onset and duration of spasticity, development of flexion deformity.

2. **Complete clinical examination:**
    - Complete general examination with stress on anthropometric measurement.
    - Complete neurological examination with entailed assessment of motor function.
3. **Assessment of Gross Motor Functional Classification System (GMFCS)** Which was a 5-level classification that distinguishes children with CP according to their gross motor abilities; limitations in gross motor function, and the requirement for assistive technologies and wheeled mobility **(Palisano, et al., 2018).**
    - Grade I: Ambulatory in all settings without Limitations.
    - Grade II: Walks without aids but has limitations in community settings.
    - Grade III: Walks with a hand-held mobility device.
    - Grade IV: Self-Mobility with limitations even with devices.
    - Grade V: Dependent for mobility requires wheel chair or adult assist.
4. **Assessment of spasticity severity grade using modified Ashworth scale (Harb A and Kishner S, 2023).** The scale was as follows:
    - 0: Normal muscle tone.
    - 1: Mild increase in muscle tone, with a catch and release or mild resistance could be detected in the affected part(s) during flexion or extension.
    - 1+: Mild increase in muscle tone, presented as a catch, followed by minimal resistance through the remainder of the ROM.
    - 2: A marked increase in muscle tone throughout most of the ROM, but affected part(s) are still simply moved.
    - 3: A marked increase in muscle tone, passive motion difficult.
    - 4: Rigidity could be detected in the affected part(s) during flexion or extension.
5. **Assessment of muscle power grade as following:**

    Grade 0: No visible motion or palpable muscle contraction.
    Grade 1: Flicker of contraction.
    Grade 2: Active motion in absence of gravity.
    Grade 3: Active motion against gravity.
    Grade 4: Active motion against resistance but not to full strength.
    Grade 5: Normal in power.
6. **Vineland Adaptive Behavior Scale (VABSA):**

The Vineland was designed to assess adaptive behaviour of subjects from birth to age ninety. This test included four sub-domains: Communication, Socialization, Daily Living Skills and Motor Skills. The VABSA offers the data needed for the assessment of numerous disabilities which include developmental delays, impaired functional skills, and learning disability. The mean total score of the VABSA, based on the Arabic version, was classified as: low adaptive behavior (≤69), below average (70-84), average (85-115), above average (116-130), and high adaptive behaviour (≥ 131) **(Farmer C et al, 2020).**

1. HR-QoL assessment using the PedsQLTM that consisted of 23 items including four multidimensional scales: physical functioning (eight items), emotional functioning (five items), social functioning (five items) and school functioning (five items)

All included children were evaluated before and 3 months after spasticity intervention therapy.

Spasticity treatment included one of the following modalities

1. **Oral baclofen**

Baclofen an analog of gama amonibutyric acid (GABA). It is available in 10 and 25 mg tablet. We started with 2.5 mg 3 times per day for children = 2 years and 5 mg 3 times per day for children from 2 to 7 years and slowly increase by 5 mg as tolerated every 3 days up to maximum dose of 40 mg / day for children from 2 to 7 years and > 7 years 60mg / day. After 12 weeks of treatment we reassed children clinically and functionally.

2. **Botulinum toxin A injections**

In our study we used botulinum toxin A it is supplied in highly purified, freeze-dried state in a vials of 100 units, stored in Styrofoam container at 5^0C. It was reconstituted by adding 2 ml of preservative free normal saline (0.9%) to get a final dilution of 5 units per 0.1 ml or 50 units in 1 ml. Once reconstituted the vial should not be agitated and should be stored at 2-4^0C until use. It remains affective for about 4 hours at room temperature. Botulinum toxin dose was 4-5 u/ kg body weight (Bw) per muscle group the maximal total dose was set at 25 u/ kg Bw for children < 5 years and 30u/kg Bw for children > six years with maximal suggested dose of 300u. Bt-A injection was done in gastrocenemius, soleus, adductor muscle, and medial / lateral hamstrings. After injection muscle relaxation was obvious within two to three hours and evaluated at 4, 12 , and 28 weeks post injection.

3. **Program of physiotherapy:**

Beginning after BTX-A injection or oral baclofen, children received treatment three times weekly for 30 min. in single session by a physiotherapist. The management consisted on upper and lower limbs by stretching of the flexor and adductor muscles, strength training of the extensor and abductor muscles, functional mobility training, and gait training.

Statistical analysis:

Data were collected, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) version 20. Qualitative data were presented as number and percentages while quantitative data were presented as mean, standard deviations and ranges.

The comparison between two groups with qualitative data were done by using Chi-square test and/or Fisher exact test was used instead of Chi- square test when the expected count in any cell was found less than 5.

The comparison between two independent groups with quantitative data were done by using independent t-test when the data were parametric and Mann-Whitney test when the data were non parametric.

Spearman correlation coefficients were used to assess the relation between two studied parameters in the same group.

The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following:

P > 0.05: Non-significant.

P < 0.05: Significant.

P < 0.01: Highly significant.

Results

Table (1): Demographic characteristics of children.

Age	**Range**	2-16	
	Mean ±SD	7.860±4.295	
		Number	**%**
Sex	**Male**	28	56.00
	Female	22	44.00

This table shows the distribution of age and sex of the studied cases

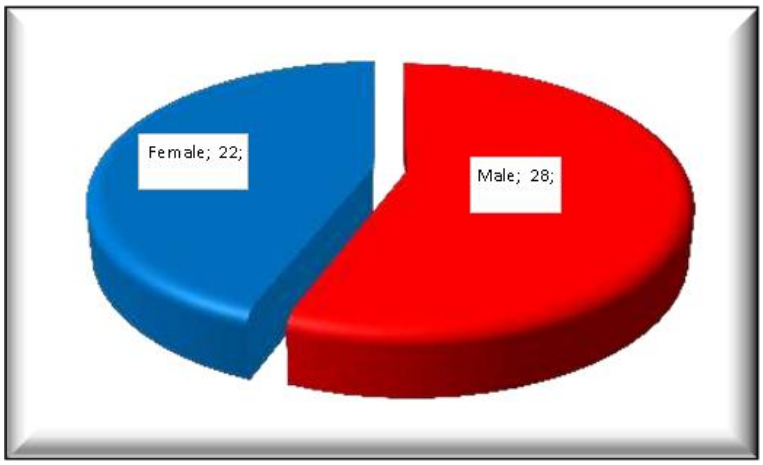

Figure 1: Gender ratio of CP children.

Table 2: Types of spastic CP.

Spastic CP Type		
	N	**%**
Hemiplegia	17	34.00
Diplegia	22	44.00
Quadriplegia	11	22.00

In our study in spastic CP types we founded 17 children with hemiplegia (34%), 22 children with diplegia (44%) and 11 children with quadriplegia (22%) **(Table 2)**.

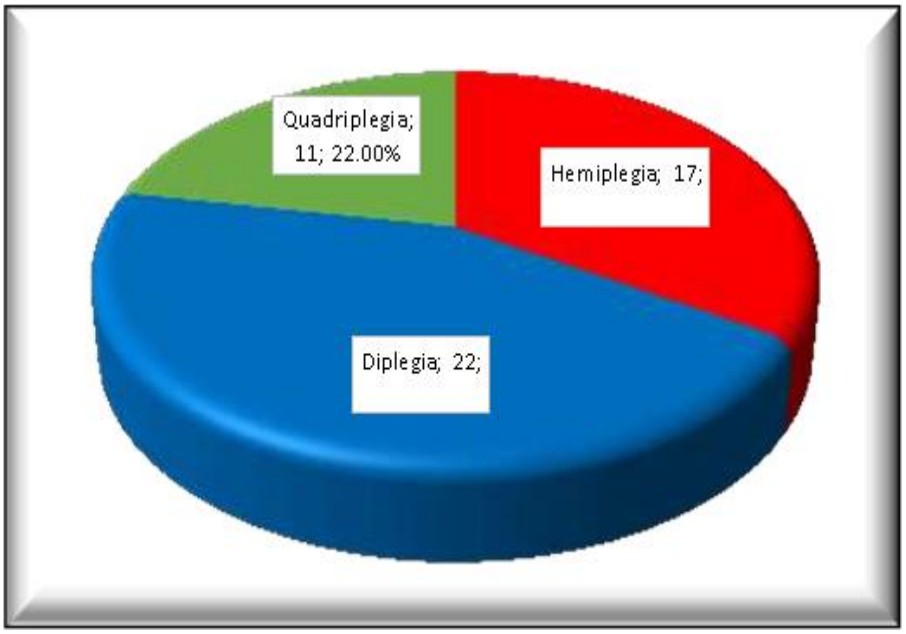

Figure 2: Types of spastic CP.

Table 3: Etiology of CP and duration of spasticity

		N	%
Etiology	**Pre natal**	**33**	**66.00**
	Peri natal	**7**	**14.00**
	Post natal	**10**	**20.00**
Etiology	**Intrauterine hypoxia**	**20**	**40.00**
	PVL	**5**	**10.00**
	IVH	**4**	**8.00**
	Toxoplasmosis	**2**	**4.00**
	CNS malformation	**2**	**4.00**
	Asphyxia	**2**	**4.00**
	Obstructed labor	**1**	**2.00**
	Trauma	**1**	**2.00**
	Low birth WT	**1**	**2.00**
	Prematurity	**2**	**4.00**
	Meningitis	**2**	**4.00**
	Hypoxic ischemic encephalopathy	**3**	**6.00**
	Neonatal convulsion	**3**	**6.00**
	Intracranial hemorrhage	**2**	**4.00**
Duration of spasticity (Months)	**Range**	**1-48**	
	Mean ±SD	**11.980±11.028**	

According to the etiology, 33 of spastic CP were prenatal (66%), 7 were perinatal (14%) and 10 were postnatal (20%).

Prenatal (Intrauterine hypoxia in 20(40%) and it was the most common cause, PVL in 5(10%), IVH in 4(8%), Toxoplasmosis in 2(4%) and CNS malformation in 2(4%)**.**

Perinatal (Asphyxia in 2(4%), obstructed labor in 1(2%), trauma in 1(2%), Low birth weight in 1(2%) and prematurity in 2(4%).

Postnatal(Meningitis in 2(4%), Hypoxic ischemic encephalopathy in 3(6%), neonatal convulsion in 3(6%) and intracranial hemorrhage in 2(4%).

Duration of spasticity ranged from 1- 48 months.

Table 4: Spasticity severity assessed by Tone Ashworth scale.

Tone Ashworth scale (grade)		N	%
Neck	**0**	48	96.00
	1	2	4.00
Trunk	**0**	41	82.00
	1	4	8.00
	2	4	8.00
	3	1	2.00
Flexor UL	**0**	8	16.00
	1	13	26.00
	+1	3	6.00
	2	12	24.00
	3	9	18.00
	4	5	10.00
Extensor UL	**0**	7	14.00
	1	8	16.00
	+1	11	22.00
	2	11	22.00
	3	7	14.00
	4	6	12.00
Flexor LL	**1**	7	14.00
	+1	5	10.00
	2	14	28.00
	3	15	30.00
	4	9	18.00
Extensor LL	**1**	3	6.00
	+1	10	20.00
	2	15	30.00
	3	13	26.00
	4	9	18.00

During our study we used Tone Ashworth Scale to asses severity of spasticity and results founded as seen in Table 4.

1: Slight increase in muscle tone, with a catch and release or minimal resistance at the end of the range of motion when an affected part(s) is moved in flexion or extension.

1+: Slight increase in muscle tone, manifested as a catch, followed by minimal resistance through the remainder (less than half) of the range of motion.

2: A marked increase in muscle tone throughout most of the range of motion, but affected part(s) are still easily moved.
3: Considerable increase in muscle tone, passive movement difficult.
4: Affected part(s) rigid in flexion or extension.

Table 5: Power grade of upper limb and lower limb.

		N	**%**
Power grade UL	**Grade 0**	2	4.00
	Grade 1	4	8.00
	Grade 2	4	8.00
	Grade 3	17	34.00
	Grade 4	12	24.00
	Grade 5	11	22.00
Power grade LL	**Grade 0**	3	6.00
	Grade 1	4	8.00
	Grade 2	12	24.00
	Grade 3	8	16.00
	Grade 4	19	38.00
	Grade 5	4	8.00

Power grade of upper limb and lower limb also measured and result seen in Table 5.

Grade 0: No visible movement or palpable muscle contraction.
Grade 1: Flicker of contraction.
Grade 2: Active movement with gravity eliminated.
Grade 3: Active movement against gravity.
Grade 4: Active movement against resistance but not to full strength.
Grade 5: Normal in power.

Table 6: IQ and grades

IQ	**Range**	20-109	
	Mean ±SD	61.060±25.383	
		N	**%**
IQ grades	**Average**	10	20.00
	Low average	2	4.00
	Borderline	5	10.00
	Mild mental retardation	13	26.00
	Moderate mental retardation	10	20.00
	Severe mental retardation	10	20.00

In this study we founded normal IQ in 17 spastic CP children (20% average IQ, 4% low average IQ, and 10% borderline) and metal retarded in 33 spastic CP children (26% mild mental retardation, 20% moderate mental retardation and 20% severe mental retardation).

IQ range from 20 to 109 and grades were measured by Wechsler IQ test scale. Average (90:109), Low average (80:89), Borderline (70:79), Mental retarded (< 69).

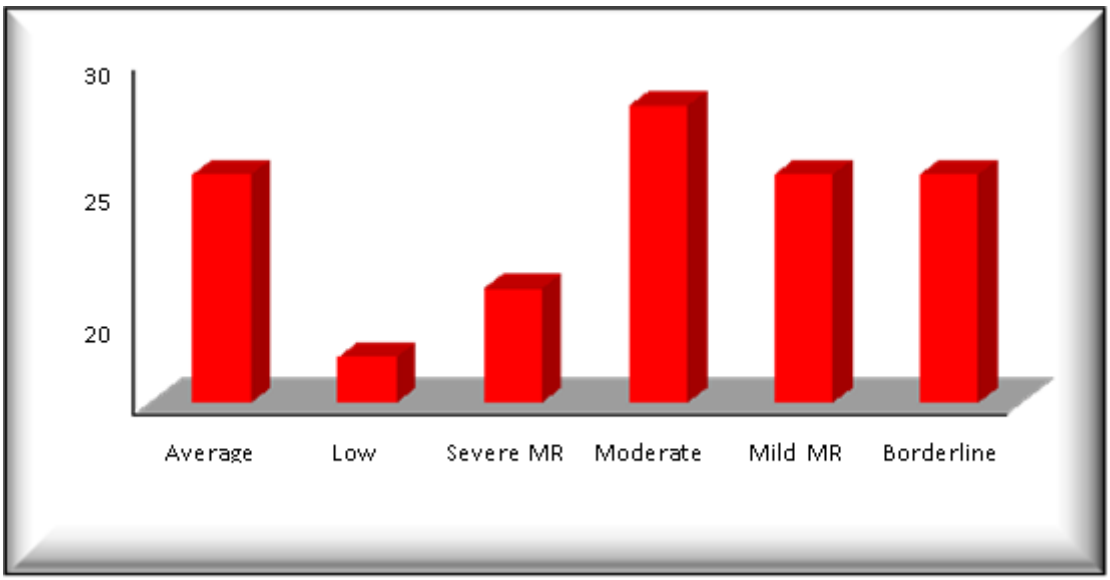

Figure 3: IQ grades

Table 7: Methods of intervention**.**

Methods of intervention		
	N	**%**
Physiotherapy and baclofen only	22	44.00
Physiotherapy, Baclofen and Botox	24	48.00
Physiotherapy, Baclofen and Surgery	4	8.00

In our study, we give to all CP children medication baclofen and physiotherapy. In 24 children we injected botox (52%) and 4 children made surgery (8%) such as selective dorsal rhizotomy (SDR) and Orthopedic procedures (Tendon lengthening). 22 children made physiotherapy only (44%), 24 children made physiotherapy and Botox (48%), and 4 children made physiotherapy and surgery (8%).

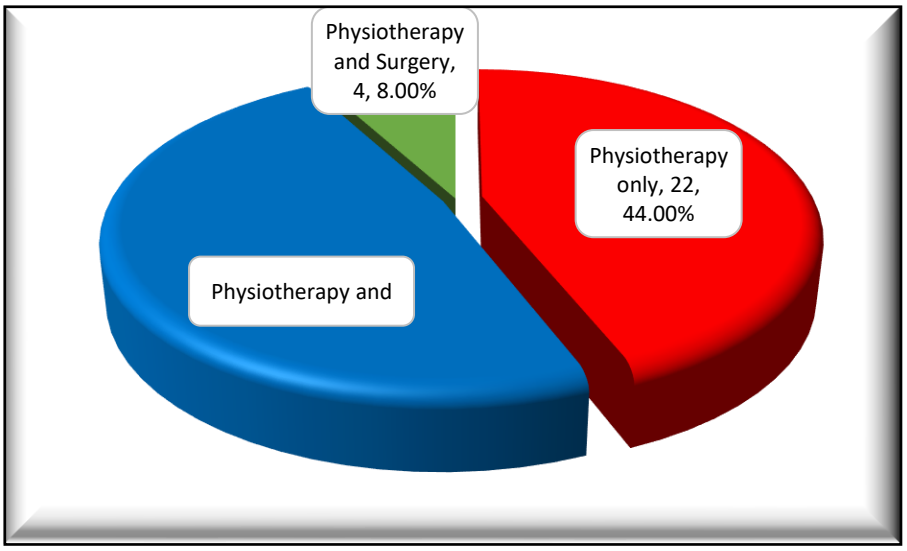

Figure 4: Methods of intervention.

Table 8: Comparison of PedsQLTM, vineland adaptive behavior scales, and gross motor function classification system scores before and after intervention

PedSQL	**Time**				**Differences**		**Paired Test**	
	Before intervention		**After intervention**		**Mean**	**SD**	**T**	**P-value**
Range	5 - 88		12 - 95		-6.660	1.423	-33.095	<0.001*
Mean ±SD	37.240 ± 26.284		43.900 ± 26.382					
VABSA	**Time**				**Differences**		**Paired Test**	
	Before intervention		**After intervention**		**Mean**	**SD**	**t**	**P-value**
Range	20 - 120		33 - 129		-18.760	8.385	-15.820	<0.001*
Mean ±SD	60.100 ± 27.024		78.860 ± 26.260					
GMFCS	**Time**				**Differences**		**Paired Test**	
	Before intervention		**After intervention**		**Mean**	**SD**	**T**	**P-value**
Range	2 - 5		1 - 5		0.740	0.394	13.269	<0.001*
Mean ±SD	3.520 ± 1.092		2.780 ± 1.375					

PedSQL= pediatric quality of life inventory, VABSA= vineland adaptive behavior scales, GMFCS= gross motor function classification system

Our study demonstrated that child with hemiplegia CP had better PedSQL , VABSA and GMFCS scales than those with diplegia and quadriplegia before intervention.

After intervention children with hemiplegia and diplegia CP showed improvement in PedSQL and VABSA scales and better improvement in motor ability than those with quadriplegic CP.

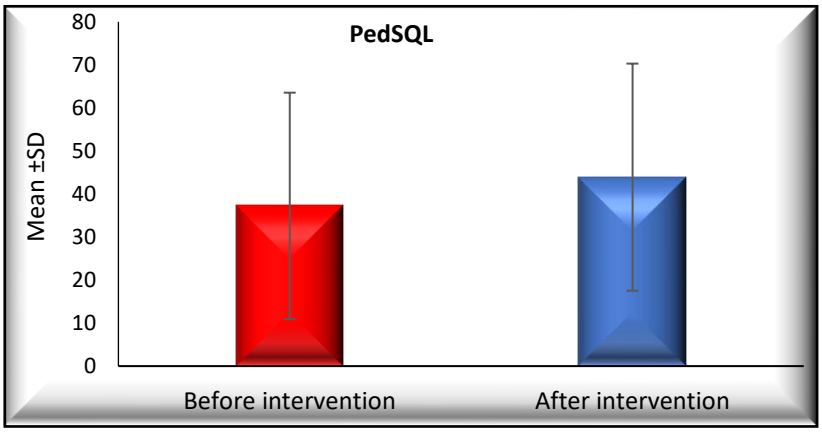

Figure 5: PedSQL scale before and after intervention.

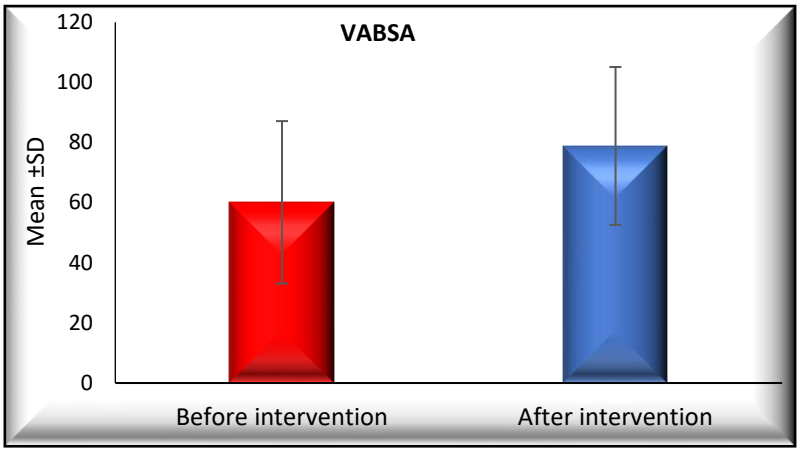

Figure 6: VABSA before and after intervention.

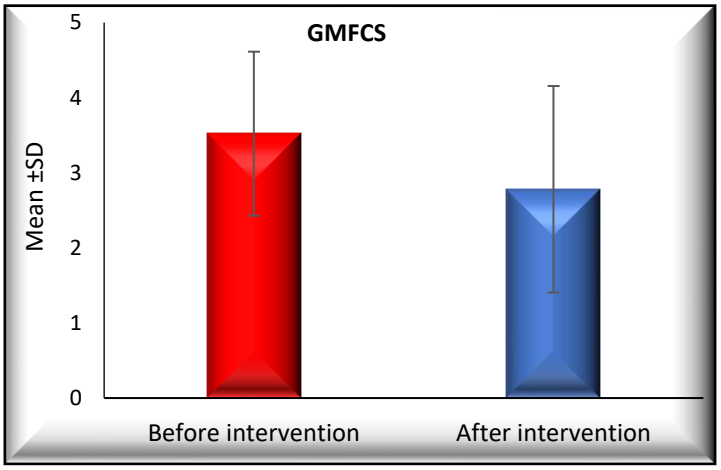

Figure 7: GMFCS before and after intervention.

Table 9: Relation between convulsions and evaluation scales before intervention.

Before intervention	**Convulsions**				**est**	
	Yes		**No**			
	Mean ± SD		**Mean ± SD**		**t**	**P-value**
PedSQL	28.909 ± 23.188		43.786 ± 27.102		-2.051	0.046*
VABSA	47.091 ± 24.386		70.321 ± 24.831		-3.310	0.002*
GMFCS	4.182 ± 0.907		3.000 ± 0.943		4.473	<0.001*

Our study showed that CP children with convulsion had worse PedSQL, VABSA and GMFCS before intervention than those without convulsion.

Table 10: Relation between convulsions and evaluation scales after intervention.

After intervention	**Convulsions**				**est**	
	Yes		**No**			
	Mean ± SD		**Mean ± SD**		**t**	**P-value**
PedSQL	35.909 ± 23.434		50.179 ± 27.260		-1.952	0.057
VABSA	65.818 ± 21.962		89.107 ± 25.077		-3.440	0.001*
GMFCS	3.614 ± 1.290		2.125 ± 1.060		4.481	<0.001*

After intervention CP children with no convulsion had better improvement than children with convulsion.

Discussion

Physical impairment in children is primarily caused by cerebral palsy, which is estimated to occur 2.11 per 1,000 live births **(Oskoui M et al., 2013)**. Diagnosis of CP requires the presence of mobility and postural affection. In children with CP, issues with movement and posture include aberrant muscle tone and stiffness, activity restriction, lack of equilibrium and changes in alignment that have an impact on motor development, and gross motor function **(Rosenbaum P et al., 2006)**.

This study aimed to assess the impact of spasticity intervention therapy on the psychometric function and QoL in children with CP.

This cross-sectional study was conducted on 50 children with documented CP with spasticity. All the included patients were subjected to assessment using various scales such as GMFCS, spasticity severity grade using modified Ashworth scale, Vineland Adaptive Behavior Scale (VABSA), and HR-QoL assessment using the Pediatric QoL Inventory TM (PedsQLTM).

Our study showed statistically significant improvement in PedSQL after intervention than before in both children received botulinum toxin and children received physiotherapy.

In the same line, **Wong et al. 2022** examined the analgesic action of a single injection of botulinum toxin in 25 CP patients with at least moderate pain (r-FLACC ≥4) throughout passive range of (assessed by r-FLACC and the Pediatric Pain Profile (PPP), respectively. Quality of life was improved in CP child after botulinum injection and was evaluated at 4, 12, and 28 weeks post injection. Quality of life improved significantly after 28 days. The total score was significantly increased ($p<0.001$). Daily pain assessed by the PPP was significantly diminished from 4 to 28 weeks**.**

Günel et al. 2022 showed that physical therapy is accompanied by improved QoL in children with CP which is similar to our findings. **Ghroubi et al. 2018** carried out a similar study to demonstrate the efficiency of BTX-A injections on spasticity as well as on the QoL in children with CP. Similar to our findings, **Kumar et al. 2023** conducted a study to assess the effect of botulinum toxin administration to children on Family QoL Survey (FQOLS). It was reported that the QoL score was improved after botulinum toxin administration.

Our study showed significant improvement in VABSA after intervention than before in children with CP. Supporting our finding, **Wong et al., 2022** reported that there was significant improvement in functional capacity of children with CP after botulinum injection. **Malek SA et al., 2022** founded improving in VABSA after intervention than before in children with CP.

Our study demonstrated significant improvement of GMFCS in children with CP after intervention than before. In agreement with our finding **Ghourabi et al., 2018** reported the change from baseline of Modified Ashworth Score ranged from 2.25 to three and from two to 2.86 for the muscles of the lower limbs and the upper limbs respectively. The mean number of injection sittings was of 3.18 (ranging from one to six). There was a significant increase in the improvement from one injection to another, reaching a steady level in the last 2 injections, which is similar to our findings.

Multani I et al., 2019 reported even if the injection's effect on muscle tone had vanished, using botulinum toxin injections as an intervention has a long-term impact on motor performance. **Juneja M et al., 2017** said long-term follow-up as the kid grows; the degree of improvement in gross motor function with aggressive physical therapy and repeated injection of botulinum toxin may be higher. In this situation, a long-term follow-up research might result in a larger improvement in gross motor functions following an injection combined with vigorous physical therapies.

Choi et al. 2019 reported that participants who got four or more repeated injections showed some improvement on the GMFCS, however the degree of improvement was less than that following the 1st, 2nd, or 3rd injections. Age has been identified as a key factor related with gains on the GMFCS after botulinum toxin injection in earlier research as well as the current study. Scores on the GMFCS achieved a plateau between ages three and seven based on their GMFCS level.

Moreover, **Rodríguez-Costa I et al. 2023** conducted a study to detect the effect of a forceful physical therapy on gross motor function, community walking and contribution to children with CP. A single group design was utilized with 2 pre-test and 2 post-test measures. Individuals were 17 ambulatory children with cerebral palsy who contributed to a forceful intervention (in other words 4 hours daily, 4 days weekly, three weeks). This study reported that an intense three-week session of physical therapy improved gross motor function, general health, and performance and satisfaction of essential activities in children with CP. **Yana M et al., 2019** comprehensive reviews indicate that there is insufficient information to draw firm conclusions about whether botulinum toxin injections combined with physical therapy facilitate higher improvements in gross motor function.

Conclusion

The spasticity intervention therapy is associated with better outcomes on the psychometric function and quality of life in children with hemiplegic and diplegic cerebral palsy represented in PedsQL, VABSA, and GMFCS scores. The presence of convulsions and quadriplegia is associated with poor outcomes after therapy.

1. There was statistically significant improved in PedSQL scale after than before intervention in spastic CP children.
2. There was statistically significant improved in VABSA score after than before intervention.
3. There was statistically significant improved in GMFCS in CP children after than before intervention.

4. Children with hemiplegia CP had better PedSQL , VABSA and GMFCS scales than those with diplegia and quadriplegia.

5. After intervention children with hemiplegia and diplegia CP showed improvement in PedSQL and VABSA scales and better improvement in motor ability than those with quadriplegic CP.

6. IQ in hemiplegic children was normal with mean 80.118, in diplegic children may be affected with mean 59.182, and in quadriplegic children was abnormal and there was a statistically significant difference between IQ and types of spastic cerebral palsy.

7. CP children with convulsion had worse PedSQL, VABSA and GMFCS before intervention than those without convulsion. After intervention CP children with no convulsion had better improvement than children with convulsion.

Recommendations

- Physiotherapy is important and should be started early to improve the quality of life in and motor ability in children with cerebral palsy.
- It is important to stress that botulinium toxin A injection is always part of a program that aims to reduce disability promoting social rehabilitation and modifying the long term of motor disorders.
- Parents and pediatrician should increase their awareness about the importance of early intervention to improve quality of life and motor ability in children with cerebral palsy.
- We should give specific attention to avoid worth outcome of high risk group including quadriplegia, mentally retarded and convulsions children with CP to improve quality of life and decrease motor disability.
- Support and encouragement families have CP children to continue physiotherapy and botulinium toxin injection to prevent motor deformities.

Limitations

- It was a single-center study.
- Small sample size.
- No placebo group.
- Short follow up period.

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