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Postural Management to Enhance Impact on Life Quality for Children with Spastic Cerebral Palsy: A Nursing and Rehabilitation Approach

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Abstract

Postural management is a highly important issue in the treatment of children with cerebral palsy (CP), but its use has not been thoroughly examined in the Middle East. The objective of this research was to determine how proper wheelchair choice could help in improving quality of life (QoL) of children with spastic cerebral palsy in Saudi Arabia. The sample used consisted of 35 children that were in a stable medical condition and had a Gross Motor Functional Measurement (GMFM) score of 3-5. The children whose parents did not consent were also excluded as well as those children who could not respond to the questionnaires of the study. The participants were all evaluated at three points namely baseline, after two weeks, and four weeks following a postural management program based on a wheelchair recommended by WHO. The findings showed that five, out of seven, domains of QoL showed statistically significant positive changes with a p-value of less than 0.001. These results will emphasize the great advantages of proper wheelchair choice in enhancing the QoL of children with cerebral palsy. Besides, the present research highlights the need to strengthen the understanding of postural management, paediatric rehabilitation, and how physiotherapy and occupational therapy may possibly optimize the treatment of children with CP.

Keywords: Postural management, quality of life, cerebral palsy, pediatric rehabilitation, wheelchair selection, spastic cerebral palsy.

INTRODUCTION

Cerebral Palsy (CP) is the most common physical disability of childhood, and the world prevalence is 2.11 per 1000 live births (Oskoui *et al.,* 2013). CP was not given an official medical classification, and it was complex, until the 18th century, although described in ancient times by Hippocrates. William Little is known to have described CP initially as a neurodevelopmental disorder (Korzeniewski *et al.,* 2018), but its etiological factors were fully explored just in the 20 th century (Michael-Asalu *et al.,* 2019). Brain asphyxia was traditionally suspected to be the major cause of CP, although more recent studies revealed that a multitude of factors, such as socioeconomic status, inflammatory reactions, respiratory distress syndrome (RDS) and postnatal trauma, could also play a role (Longo & Hankins, 2009; Marret *et al.,* 2013).

CP may be categorized according to the muscle spasticity into the spastic and non-spastic cerebral palsy. Also, it is further separated into spastic, dystonic, and ataxic (Himmelmann, 2013). The main aim of the CP management is to prevent the complications, reduce comorbidities, improve the quality of life, and improve the motor, cognitive, and social functioning of the affected people (Michael-Asalu *et al.,* 2019). Occupational therapists and physiotherapists will be crucial in enhancing and sustaining motor abilities of the CP patients. Nonetheless, occupational therapy encompasses more than the ability to improve the motor functioning, and the full functionality of CP patients is

not ensured by the increase in muscle strength (Chikwahna *et al.,* 2015; Graham *et al.,* 2016).

The respiratory functional aspect is one of the key areas that should be highlighted by physiotherapists and other healthcare experts when working with CP patients (Gulati and Sondhi, 2017). The postural management is very helpful to enhance the respiratory care and motor functioning. The literature has already shown that postural interventions are severe enough to decrease the number of complications related to CP, especially when patients have severe gross motor difficulties (Meyling *et al.,* 2018; Ravi *et al.,* 2017).

The rates of CP in Saudi Arabia have been estimated at 2.3 per 1000 live births. This prevalence might be connected with early maternal age and consanguineous marriages, which would be considered hereditary factors (Rifai *et al.,* 2017; Salloum *et al.,* 2011). Nonetheless, rehabilitation facilities that are accessible to help address the needs of children with disabilities are scarce particularly in the rural regions and there is a high stigma towards families with CP. Poor nutrition and non-provision of care has an adverse effect on the quality of life and care of such children as well (Almuneef *et al.,* 2019; Soliman *et al.,* 2021).

Most CP patients and caregivers lack proper wheelchairs or they lack instructions on the proper use leading to high rates on wheelchair abandonment. When wheelchairs are poorly used, they can cause severe health conditions such as hip pains, pressure ulcers, skin damages, and falls (Toro *et al.,* 2015). WHO has been able to make comprehensive recommendations concerning the assessment and training of the wheelchairs, to improve the selection of the wheelchairs available in the settings where such resources are scarce (Khasnabis *et al.,* 2013).

The previous analyses of the quality of life of families and individuals with CP identify pain as one of the most significant issues that deteriorate the quality of life (Blackman *et al.,* 2018). The aim of the research is therefore to investigate the use of appropriate choice of the wheel chair to enhance quality of life among children with spastic cerebral palsy.

METHODS & DATA COLLECTION

Study Design

The research design used was a quantitative interventional study design that aimed to examine the implication of postural management on quality of life (QoL) of children with spastic cerebral palsy (CP). The research was conducted at the Seating and Position Clinic of the Rehabilitation Services of Sultan Bin Abdulaziz Humanitarian City (SBAHC) of Riyadh, Saudi Arabia. SABHC is an evidence-based health and rehabilitation agency that deals with children living with CP (SBAHC, 2020).

Ethical Considerations

The SBAHC Ethics Committee and the UniSZA Human Research Ethics Committee (UHREC) accepted the study. The caregivers of all the participants gave an informed consent in writing during data collection. The consent form was precise in that it mentioned that the participation was voluntary and there would be no impact on the medical management plan in case of a refusal. The information gathered was anonymous and the answers of the electronic questionnaires were safely deposited and could only be viewed by the main researcher.

Participants

Children diagnosed with spastic CP having an age of 4-12 years were eligible to include them in the study. The participants were picked through a non-randomized, consecutive quasi-sampling technique of the Seating and Position Clinic. G Power Software was used in determining the sample size and 35 participants selected in order to have power of 0.81. Those children who had Gross Motor Function Measurement (GMFM) score of between 3 and 5 with stable medical conditions during the admission period were part of the study. The exclusion criteria consisted of parents who did not give their consent, as well as those children who could not answer the questionnaire. The parents of all eligible participants were explained about the study in detail.

Study Protocol

The participants underwent three evaluation intervals:

1. Baseline (Day 1),
2. Two weeks post-intervention,
3. Four weeks post-intervention.

At each interval, participants underwent testing and assessments to evaluate the effects of postural management using appropriate wheelchairs based on the World Health Organization (WHO) guidelines for wheelchair selection (Khasnabis *et al.,* 2013).

Wheelchair Selection and Caregiver Education

A comprehensive physiotherapy assessment was conducted to determine the appropriate wheelchair for each participant. Based on the assessment, caregivers were trained in wheelchair safety, correct positioning, wheelchair adjustability, techniques to prevent pressure ulcers, and proper usage. The caregiver training included 30-minute educational sessions held five days a week, each session comprising:

- 10 minutes of theoretical education and demonstration,
- 10 minutes of practical transfer training,
- 10 minutes of practical sitting training.

Quality of Life Assessment

The Cerebral Palsy Quality of Life (CPQOL) questionnaire was administered to assess the impact of postural management on the quality of life of the participants. The CPQOL tool, developed by a

multidisciplinary team across four countries (Australia, Scotland, Germany, USA), includes 65 questions distributed across seven domains:

- Feelings about functioning,
- Participation and physical health,
- Family health.
- Emotional wellbeing,
- Social wellbeing,
- Pain and the impact of the child's disability,
- Access to services,

Each question has nine possible responses (ranging from 1 – very unhappy to 9 – very happy). The Arabic version of the CPQOL was administered through face-to-face interviews, with a brief explanation about the purpose and methodology. The Arabic translation was validated in a 2017 study conducted on an Egyptian population (El-Weshahi *et al.,* 2017).

Data Analysis

The responses from the CPQOL were entered into a Microsoft Excel spreadsheet. The scores were then transformed into a 100-point scale based on predefined conversion:

- 1 → 0,
- 2 → 12.5,
- 3 → 25,
- 4 → 37.5,
- 5 → 50,
- 6 → 62.5,
- 7 → 75,
- 8 → 87.5,
- 9 → 100.

Microsoft excel was used to do data cleaning and numerical coding. Statistical analysis was done through SPSS (Version 25) and Kolmogorov-Smirnov tests were used to check the distribution of data through normality tests. Continuous variables were analyzed by the use of T-tests and ANOVA and paired sample t-test was utilized to compare pre- and post-intervention scores of CPQOL. At p = 0.05, statistically significant was taken into account. Also, the multivariate analysis was used to test the adjusted impacts of the study variables on the QoL outcomes.

RESULTS

Participant Demographics

The study involved 35 children who had spastic cerebral palsy (CP). The sample was of mean age 8 ± 2.7 years with ages ranging between 4-12 years of age. According to gender 51.4 were males and 48.6 were females. About type of wheelchair, 45.7 percent of participants were issued with the standard WHO wheelchair, 34.3 percent had WHO active wheelchair and 20 percent received WHO pushchair. The demographics of the participants are provided in Table 1. Figure 1 indicates the demographic structure of the respondents based on age brackets, gender and the type of wheelchair that the respondents used and the proportions of the various types.

Table 1: Socio-Demographic Characteristics of Study Subjects and Type of Provided Wheelchair (n = 35)

Variable	Number	Percent
Age (mean ± SD = 8.0 ± 2.7 years)		
4 – 6 years	12	34.3%
7 – 9 years	12	34.3%
10+ years	11	31.4%
Gender		
Male	18	51.4%
Female	17	48.6%
Type of Wheelchair Provided		
Standard wheelchair	16	45.7%
Active wheelchair	12	34.3%
Push wheelchair	7	20%

Quality of Life Improvements

Postural management resulted in statistically significant improvements in five out of seven CPQOL domains. Significant improvements were observed in the following domains:

- Social Wellbeing and Acceptance: The mean score increased from 556.4 ± 91.9 at baseline to 642.8 ± 99.5 after four weeks (p-value < 0.001).
- Feelings About Functioning: The mean score increased from 597.8 ± 92.3 to 670.7 ± 97.3 (p-value 0.003).
- Participation and Physical Health: The mean score improved from 508.2 ± 120.2 at baseline to 611.4 ± 128.1 after four weeks (p-value 0.001).
- Emotional Wellbeing and Self-Esteem: The mean score increased from 276.7 ± 69.6 to 319.2 ± 90.6 after four weeks (p-value 0.033).
- Access to Services: The mean score improved from 563.9 ± 119.9 to 672.5 ± 121.3 (p-value 0.001).

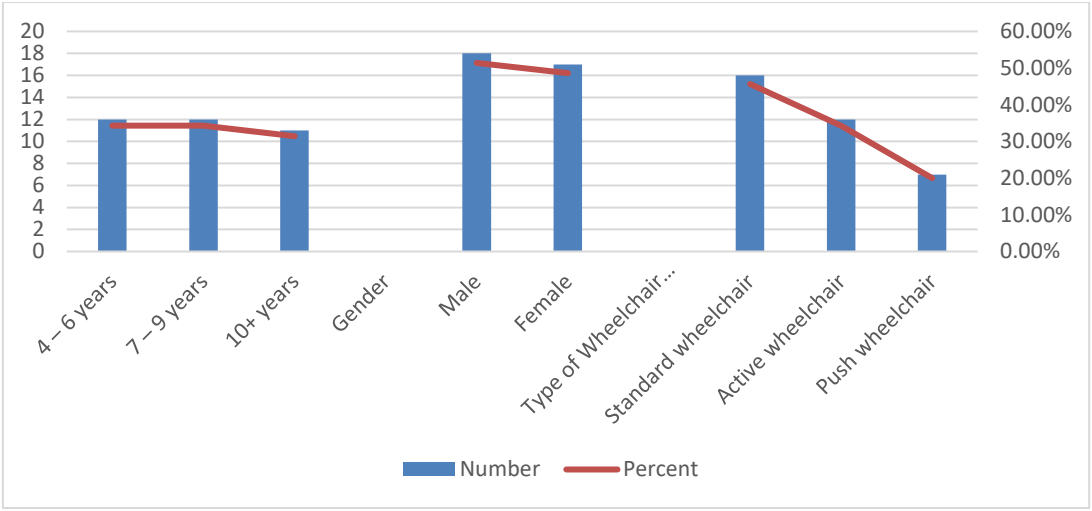

Figure 1: **Demographic Distribution of Participants by Age Group, Gender, and Type of Wheelchair Provided**

Conversely, the domains of Pain and Impact of Disability (p-value 0.184) and Family Health (p-value 0.301) did not experience any significant changes. Table 2 summarizes the entire information about these improvements. Specifically, the pie chart developed in Figure 2 compares the statistically significant findings of the CPQOL domains, and the discussion centers on the positive changes that the domains such as the Social Wellbeing, Feelings About Functioning, and Participation and Physical Health showed.

Table 2: Cerebral Palsy Quality of Life (CPQOL) Scores Pre, During, and Post Postural Management (n = 35)

Domain	Baseline	After 2 Weeks	After 4 Weeks	p-value
Social Wellbeing and Acceptance	556.4 ± 91.9	615 ± 101	642.8 ± 99.5	< 0.001**
Feelings About Functioning	597.8 ± 92.3	616 ± 113.7	670.7 ± 97.3	0.003**
Participation and Physical Health	508.2 ± 120.2	595 ± 116.6	611.4 ± 128.1	< 0.001**
Emotional Wellbeing and Self-Esteem	276.7 ± 69.6	310.3 ± 70.9	319.2 ± 90.6	0.033**
Access to Services	563.9 ± 119.9	619.6 ± 114.5	672.5 ± 121.3	0.001**
Pain and Impact of Disability	386.4 ± 82.8	403.5 ± 93.7	411.7 ± 81.2	0.184
Family Health	194.2 ± 47.6	195.7 ± 58.7	210 ± 68.8	0.301
Total Score	3083.9 ± 206.6	3355.4 ± 98.3	3538.6 ± 186.9	< 0.001**

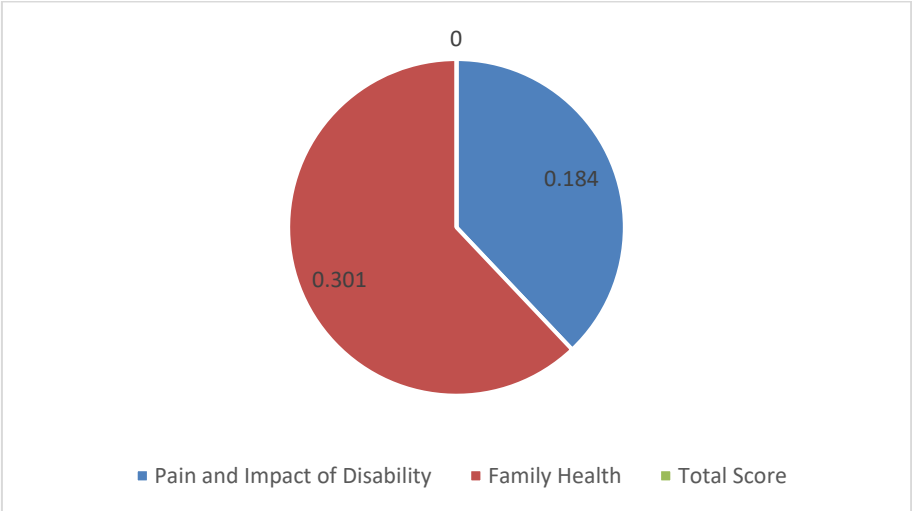

Figure 2: Statistically Significant Results Across CPQOL Domains, Focusing on Improvements in Social Wellbeing, Feelings About Functioning, and Participation and Physical Health

Correlations Between Study Variables

Triggering the correlation analysis of the variables of the study with the overall CPQOL scores, the statistically significant relationships were identified between the age, gender, weight, height, and the type of wheelchair and the total CPQOL scores in the 4-week follow-up (all p-values > 0.05). Table 3 shows the results of the correlation. In Figure 3, the correlations among the

study variables are shown visually, which gives the relationship between the age, height, weight, wheelchair type, and the overall CPQOL score.

Table 3: Correlations Between Study Variables Post Postural Management Using a Proper Wheelchair (n = 35)

Variable	Age (Years)	Height (cm)	Weight (kg)	Gender	Wheelchair Type	Total CPQOL
Age (Years)	1.000	0.990**	0.981**	-0.249	0.168	-0.041
Height (cm)	0.990**	1.000	0.982**	-0.198	0.146	-0.028
Weight (kg)	0.981**	0.982**	1.000	-0.216	0.135	-0.087
Gender	-0.249	-0.198	-0.216	1.000	0.006	-0.034
Wheelchair Type	0.168	0.146	0.135	0.006	1.000	-0.208
Total CPQOL	-0.041	-0.028	-0.087	-0.034	-0.208	1.000

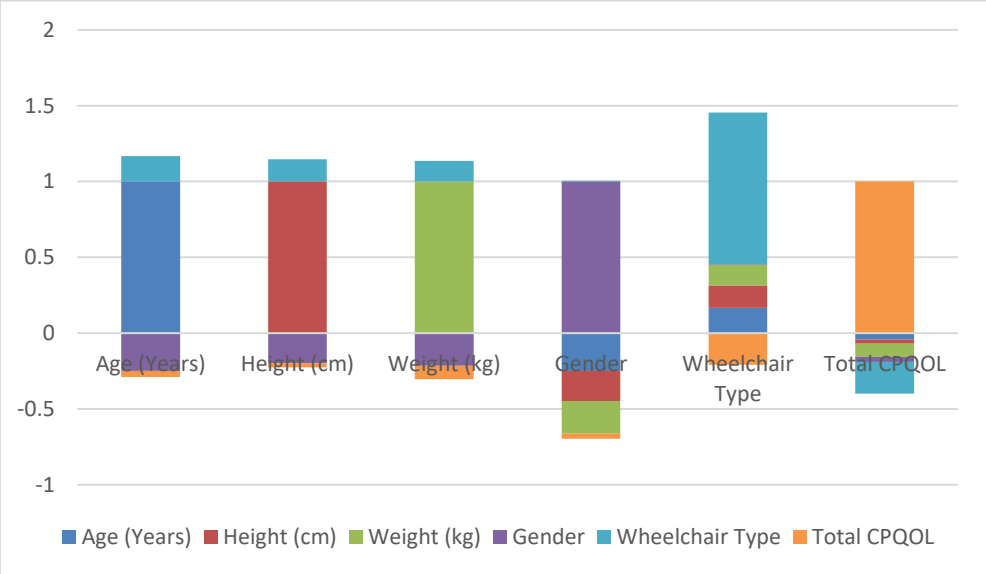

Figure 3: Correlations Between Study Variables (Age, Height, Weight, Wheelchair Type) and Total CPQOL Scores

DISCUSSION

The significance of appropriate wheelchair choice in children with cerebral palsy (CP) is difficult to overestimate, especially in the areas where the special rehabilitation facilities are scarce. In most of the developing states, these services might be limited and it is important to make sure that the children with CP are provided with proper postural management so that their quality of life (QoL) could be better. Our research results are consistent with other similar large-scale intervention in Indonesia, which also identified that adequate wheelchair choice, guided by WHO standards, created significant QoL enhancements to patients with CP, specifically female participants (Toro *et al.,* 2015). This is similar to our findings where the respondents showed tremendous differences in their overall CPQOL scores at the end of four weeks of postural management in the use of a proper wheelchair.

Other researchers have stressed the importance of having adequate support in the wheelchair in enhancing the functional performance of the CP patients. As an example, one of the studies carried out in Turkey found that 8 out of 10 CP pediatric patients did not use a wheelchair that matched their functional and clinical requirements (Ekiz *et al.,* 2017). On the same note, Japanese studies indicated that, of the CP patients, about half of them failed to receive proper support when using their wheelchairs, an issue that adversely impacted their functional capability and health in general (Hatta *et al.,* 2007). Early intervention and the right choice of wheelchair in childhood is of great importance as it can lead to higher mobility and further autonomy of patients with CP (Rodby-Bousquet and Hagglund, 2010).

Although some studies about CP postural management have paid more attention to the physical component of the wheelchair support, there are fewer studies that have examined how the intervention affected the quality of life of the patients and their families (Lie *et al.,* 2014; Roby-Bousque and Hagglund, 2010). A small-scale Japanese study, which included three children, showed that positive functional results were achieved when the postural and foot support was considered in the design of wheelchairs (Shirogane *et al.,* 2017). A different intervention study that has been carried out in Taiwan that included 20 CP patients showed that the use of wheelchairs with appropriate support system have a significant effect in the body positioning and general functional advantages to CP

patients (Liu *et al.,* 2014). These outcomes are comparable to the outcomes of our study which have shown that postural management and appropriate wheelchair support did not only positively impact physical functioning but also had beneficial influence to various areas of QoL.

Postural intervention studies on standing devices conducted in Sweden indicated a substantial beneficial change in the quality of life of children with CP, which supports the notion that postural management is useful in improving the overall wellbeing of children with CP (Nordström, 2014). It is consistent with our results, which have revealed the positive changes in social wellbeing, emotional wellbeing, and service access, which are the areas that are important to enhance the life of children with CP.

There are however limitations to this study. To begin with, it is not very easy to draw a direct cause-effect link between the intervention and improvements as the study is not randomized. Moreover, the sample size is quite small and the rehabilitation services provided at Sultan Bin Abdulaziz Humanitarian City are of a high quality, which could restrict the overall applicability of our results especially in more disorganized environments. More so, the limitations can be addressed in future research through implementation of blinded randomized procedures and increase in the study time to come up with results that are more sustainable and generalized.

CONCLUSION

The research has shown that postural management, in particular the use of suitable wheelchair can immensely enhance the life quality of spastic cerebral palsy children especially in their social wellbeing, sense of functioning, engagement in physical health, emotional wellbeing, and access to services. These results imply the need to offer proper rehabilitation support and wheelchair to this at-risk group of people.

The advantages of an adequate choice of the wheelchair to CP patients are obvious and serve as the argument to promote more awareness and to recommend better postural management in pediatric rehabilitation. This may result in better functional performance and quality life of children with CP. Moreover, the research identifies the significance of physiotherapy and occupational therapy to these children, and it can lead to better health and autonomy of this group of children.

Considering such findings, we suggest that in future studies, large, multi-center, research with randomized controlled trials should be conducted to determine how postural management interventions have long-term effects. These studies will assist in defining more generalizable evidences and get clearer information about the sustainability of the benefits of the present study.

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