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Reduction in Spasticity Following Postural Management Using Proper Wheelchairs in Children with Spastic Cerebral Palsy in Saudi Arabia

MajdaldeenM. I. Ashqar[a], Dr. Naresh Bhaskar Raj[b*], Sadia Misbach[c], Dr. Akram Amro[d],Dr.Wan Arfah Nadiah[e]

[a]*Rehabilitation Services, Sultan Bin Abdulaziz Humanitarian City, Riyadh, Kingdom of Saudi Arabia*

Provide Majdaldeen M. I. Ashqar, Occupational Therapist, Sultan Bin Abdulazeez Humanitarian City, P.O Box: 64399, Riyadh, Kingdom of Saudi Arabia.

[b] Dr. Naresh Bhaskar Raj, Faculty of Health Sciences, School of Rehabilitation, Universiti Sultan Zainal Abidin, Kuala Nerus, Kuala Terengganu, Malaysia.

*corresponding author

[C]Sadia Misbach, Director Rehabilitation, Sultan Bin Abdu Aziz Humanitarian City, Riyadh – KSA,
[d]Dr. Akram Amro
Quds University, Physiotherapy department, Jerusalem, Palestine.

[e] Dr. Wan-Arfah Nadiah, Faculty of Health Sciences, Universiti Sultan Zainal Abidin, Kuala Nerus, Kuala Terengganu, Malaysia.

Abstract:- Postural management plays a major role in the management of cerebral palsy patients. Studies on this subject are scarce in the Middle Eastern region. The objectives of the current study are to measure the effect of proper wheelchair selection on spasticity. Spasticity cerebral palsy patients, aged between 4 and 12 years, with a Gross Motor Functional Measurement score between three and five were eligible to be included in this study. The current study took place between July and December of 2020.Each included case was assessedfor muscular spasticity at three measurement intervals: on day one, after two weeks and after four weeks from the initial postural management intervention using proper wheelchair according to the World Health Organization protocol.Thirty-five children participated in this study. Postural management was associated with a statistically significant bilateral reduction in Modified Ashworth Scale score between the baseline and after 4 weeks of following up in the shoulder, elbow, wrist and hip joints (p-value <0.001). The results of this study can be used to highlight the benefits of proper selection of wheelchairs for this vulnerable group. They can be used to increase awareness regarding occupational therapy potential benefits. These results could be used to advocate for providing cerebral palsy patients with better postural management so they can achieve better health status.

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Keywords: cerebral palsy; disabled children; spasticity; wheelchairs; postural management; rehabilitation

Introduction:

Cerebral Palsy (CP) is the most prevalent childhood disability. Early description for CP goes back to Hippocrates writings (1). However, due to the multifactorial and difficult nature of CP, a formal description did not appear in the literature before the eighteenth century. William Little was the first scientist to formally describe CP as a neuro-developmental illness. Meanwhile, the etiological and clinical course of CP was not properly investigated until the twentieth century (2,3).

Several methods were used to classify cerebral palsy, yet the most common and straightforward classification is according to muscle spasticity, with the main two categories being spastic and nonspastic cerebral palsy. The most common type of childhood CP is spastic CP, which affects about 75% of people with CP (4).

It was estimated that the global prevalence of CP is 2.1 per one thousand live births (5). Al Salloum et al. reported a 2.3 per 1000 live birth prevalence of CP in Saudi Arabia (6). The high prevalence of CP in Saudi Arabia is in line with other countries in the Middle East region and partially this could be explained by the high level of consanguinity marriage and its associated hereditary diseases, in addition to early maternal age (6,7).

The management plan of cerebral palsy requires a multidisciplinary team and it needs to prioritize the family's needs and expectations (4). Physiotherapists play a major role in this management process and referral for physical therapy usually happens as soon as a CP case is diagnosed or suspected in order to maintain or to improve the motor function (8). Recently, occupational therapists are also being involved in CP management to provide the patients with tailored functions according to their needs (9).

Studies have shown that improving the motor function and muscular strengths alone do not necessarily mean better function, so occupational therapy services aim to cover this gap between function and motor function improvement (9,10). Postural management has a substantial contribution to both motor function and respiratory care for CP patients. Several studies revealed that postural management significantly decreases CP complications, especially in patients with severe gross motor dysfunction (11,12).

Saudi Arabia, especially in peripheral areas, lacks accessible rehabilitation centers for people living with disabilities (13). Furthermore, previous studies showed that there is a high stigma level towards families of children with CP and a high prevalence of malnutrition among Saudi CP children (14,15).

Many CP patients are not provided with proper wheelchairs or the patients and caregivers are not appropriately and sufficiently trained on the optimal usageof the wheelchair. Therefore, there is a high rate of wheelchair abandonment among patients with severe CP disabilities (16). A prior study has revealed that 80% of CP patients did not use suitable wheelchairs for their conditions (17).

Improper wheelchair use in CP patients is associated with pressure ulcer, hip pain and falling down risks(18,19). For example, Newman et al. reported a high prevalence of skin injuries

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among wheelchair dependant CP patients(19). Similarly, Alkhateeb et al. associated prolonged seating in the wheelchair with pain in cerebral palsy patients(20).

The World Health Organization (WHO) created a detailed guide for wheelchair assessment and training that facilitates the process of selecting appropriate wheelchair for CP patients and it is adapted to the needs of countries with limited resources (21). There is a need for proper postural management of CP patients using proper wheelchairs, as they could provide the patients with the needed support to the vertebral, trunk and neck. Moreover, proper wheelchairs could facilitate the movement process of CP patients(20,22).

The objectives of the current study are to measure the effect of proper wheelchair selection on spasticity of children with cerebral palsy.

Materials and methods:

To achieve the objectives of the current study, a quantitative interventional study design was selected. The current study was conducted at the seating and position clinic in the Rehabilitation Services and program at Sultan Bin Abdulaziz Humanitarian City (SBAHC). SBAHC provides CP children with rehabilitation and health care services (23–25). SBAHC is located in Riyadh the capital city in Saudi Arabia, with a population estimate of eight million inhabitants (26). Data collection was performed through a self-administered electronic questionnaire on a tablet and the primary researcher facilitated it. Spasticity CP patients, aged between 4 and 12 years were eligible to be included in this study when they were admitted as an inpatient to SBAHC. A non-random and non-blinding consecutive quasi sampling protocol was used based on workflow in the seating and position clinic.

Inclusion criteria included a Gross Motor Functional Measurement score (GMFM) between three and five and stable medical conditions at the time of admission. Children whose parents did not sign the consent form or did not answer the questionnaire were excluded from this study.

A detailed face-to-face explanation was given to the parents of all eligible patients. All included cerebral palsy patients were recruited by a non-random consecutive sampling protocol and they were evaluated by repeated measures during their visits to the seating and position clinic. Each included case was tested and assessed at three measurement intervals: on day one, after two weeks and after four weeks from the initial postural management intervention using proper wheelchair in accordance to the World Health Organization (WHO) protocol (21)

A comprehensive physiotherapy assessment was performed for each case to reach a diagnosis and select the appropriate wheelchair according to WHO criteria. After that, the parents or caregivers were educated about the proper positioning, safety transfer, methods to prevent pressure ulcers, adjustability of the wheelchairand proper way of using the wheelchair. The caregivers were requested to attend 30 minutes of educational sessions for five days per week. Each educational session was divided into 10 minutes of theoretical education and demonstration, 10 minutes of practical proper sitting training and 10 minutes of practical proper transfer training.

At the baseline, after two weeks and after four weeks of postural management, a Modified Ashworth Scale (MAS) physical assessment was performed for each included patient (see figure 1).

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The Modified Ashworth Scale (MAS) is the gold standard and most common measurement tools to assess muscular spasticity among researchers (27). It is an ordinal scale used for grading the muscle resistance encountered during passive muscle movement, ranging from zero scores up to four scores. The modified scale included +1 to measure the minor increase in muscle tone, displayed by a catch, followed by the lowest resistance level throughout the remaining range of movement (28).

Zero MAS score is indicated when there is no increase in muscle tone, 1 score is indicated when there is a slight rise in muscle tone, revealed by a catch and release or by a minimal level of resistance at the end of the ROM (range of movement) when the examined part is moved in flexion or extension, 1+ score is indicated when there is a slight increase in muscle tone, shown by a catch, followed by minimal resistance all over the remainder of the ROM, 2 scores is indicated when there is a more noticeable intensification in muscle tone through most of the ROM, but affected part(s) easily moved, 3 scores are indicated when there is a considerable increase in muscle tone – passive movement difficult, and 4 scores is indicated when the affected part(s) is rigid in flexion or extension (29).

Written ethical approval was obtained from the UniSZA Human Research Ethics Committee (UHREC) and the Sultan Bin Abdulaziz Humanitarian City Ethics Committee. A hard copy of a written, informed consent was collected from all caregivers of the included subjects in this study. It was mentioned in the consent form that the voluntary participation in the study or refusal to participate will not affect the management plan. The data collected in this study were anonymous and the filled out electronic questionnaires were stored securely and only the primary investigator had access to the data.

The anonymous data were numerically coded and cleaned in an Excel sheet (Microsoft Corp., Redmond, WA, USA). Then, Statistical Package for Social Science (SPSS) (SPSS incorporation, Chicago, Illinois, USA) version 25 software was used for data analysis. The data normality of data set was checked using Kolmogorov-Smirnov normality test. Data were interpreted as statistically significant when p-value < 0.05. A paired sample t-test was used to compare the scores pre and post postural management intervention.

Results:

Thirty-five children participated in this study. The mean age of the subjects was 8.0 ± 2.7 years, ranging between 4 and 12 years, almost equally divided between the two genders, 51.4% and 48.6% male and females, respectively. Around half of the study subjects were provided with a WHO standard wheelchair type after proper assessment of their postural management needs, 34.3% of them were provided with WHO active wheelchair type and 20.0% were provided with WHO pushchairs type. Sociodemographic characteristics of study subjects and the wheelchair type that was given to them are shown in Table 1.

Based on Kolmogorov-Smirnov normality test results, MAS measurements were not normally distributed. Postural management using a proper wheelchair in children with cerebral palsy was associated with a statistically significant bilateral reduction in MAS score between the baseline and after 4 weeks of following up in the shoulder, elbow, wrist and hip joints (p-value <0.001). Meanwhile, the MAS score did not change significantly in the knee and ankle joints.

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Changes in MAS scores of study subjects are shown in Table 2.

Discussion:

There is a high need for a proper wheelchair selection, especially in developing countries where rehabilitation services might not cover all CP population in need of these proper services (16). A recent cross-sectional study from Turkey revealed that 8 out of 10 CP children did not use an appropriate wheelchair for their clinical and functional needs (17). In addition, a Japanese study showed that around half of CP patientsdid not receive an appropriate postural support while they were using wheelchairs, which could negatively affect their health and functional status (30). Rodby-Bousquet and Hägglund (2010) reported that early intervention during the childhood and early development years by proper wheelchair selection would improve CP patients' mobility outcomes and potentially increase their independence (22).

Most previous studies were observational and cross-sectional and there is an apparent scarcity in interventional postural management studies. One of the few examples of interventional studies is a postural study conducted by Alkhateeb et al. (2019)on nine CP patients in Jeddah, Saudi Arabia. It concluded that the adjustment of head and neck support in the wheelchair would result in better body parts positions and subsequently benefit the patients (20). Alkhateeb et al. (2019) findings are in line with the current study finding in that the postural management with proper wheelchair selection yielded with better MAS score. However, the scope of the current study was on wheelchair selection rather than wheelchair adjustment.

Moreover, a retrospective study in the United Kingdom showed that proper wheelchair selection for more than 100 CP patients improved their function and significantly decreased the spasticity (31). The current study results showed a similar trend of spasticity scores improvement after postural management in spastic Saudi CP children.

Meanwhile, another small-scale interventional study involving only three patients in Japan showed promising objective results for the CP patients when postural and feet support was applied in the wheelchairs (32). Similarly, another interventional study involving 20 CP patients in Taiwan revealed that using wheelchairs technology that provides proper support would improve body parts alignment and benefit CP patients(33). Furthermore, McDonald and Surtees conducted an interventional study involving 23 British CP patients who were managed by postural intervention on the knee level. McDonald and Surtees'(2007) intervention failed to significantly improve CP patients(34). Our study results contradict McDonald and Surtees (2007) findings, but this could be explained by the differences in postural management intervention and by differences in the study methodology.

Additionally, Vekerdy (2007) conducted a postural interventional study on 47 CP children in Hungary. The results of this study also included an objective measurable improvement in the posture of involved CP patients(35). Although objective measurement of CP children's posture status was outside the scope of the current study, the improvement in joint spasticity show the same trend of improvement after postural management interventions for CP children.

Based on current study results, measuring the causality between intervention and results is limited (36). Also, the small sample size and non-random selection of study participants limit the generalization of current study findings.

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In addition, rehabilitation services at Sultan Bin Abdulaziz Humanitarian City are known to be high standard services all over the Saudi Arabia Kingdom. This fact would increase the expectations of study participants and possibly improve their compliance with postural management. Therefore, the generalization of the current study findings to other centers with possibly less standardized rehabilitation services would be limited. However, the primary researcher tried his best to include CP children from the capital city Riyadh and from surrounding areas as well.

The current study is the first interventional study on postural management for CP children in the city of Riyadh and it included a gold-standard assessment tool to examine the effects of postural management using a proper selection of wheelchairs. The comprehensive assessment spasticity aspects of this intervention would help in building primary evidence about the benefits and potentials of this crucial intervention. Moreover, the comprehensive assessment of this aspect and its detailed effects on CP scores enriched the current study findings with unique physiotherapy research perspectives. Although the sample size was small, it is larger than several other interventional postural management studies on CP children and this would help with building future larger-scale studies.

In conclusion, postural management using a proper wheelchair has led to statistically significant improvement in the spasticity score. The results of this interventional study can be used to highlight the benefits of proper selection of wheelchairs for this extremely vulnerable group. They can also be used to increase awareness regarding the postural management and pediatric rehabilitation services, as well as increasing the visibility of physiotherapy and occupational therapy potential benefits. These evidence-based results could be used to advocate for providing spastic CP patients with better postural management so they can achieve better health status.

Based on the current study results, it is recommended to have further future large-scale studies to examine the subjective and objective effects of postural management using proper wheelchairs. However, in order to have a better generalization of future study results, it is recommended to plan the coming interventional studies on blinded randomized methodology.

In addition, the follow-up duration of the current study was only four weeks. Therefore, there is a need for future long-term and longitudinal research in order to identify the sustainability of postural management effects on spastic CP patients. Lastly, the current study was a single-centre interventional study, and the generalization of single-centre study results is limited. Thus, it is recommended to have multi-center or even better, multi-country interventional postural studies on spastic CP children so the evidence will become more robust and conclusions could be generalized.

Health authorities are encouraged to allocate sufficient resources and funds for the postural management interventions in order to avoid or delay potential adverse health and psychological consequences of spastic CP.

It is favored to have a screening program for those who could benefit from postural management using a proper wheelchair, such as spastic CP children probably living in underprivileged or out of reach areas for early detection and prevention of negative health and functional consequences among those children.

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References:

1. Panteliadis CP, Vassilyadi P. Cerebral Palsy: A Historical Review. In: Panteliadis CP, editor. Cerebral Palsy [Internet]. Cham: Springer International Publishing; 2018 [cited 2020 Dec 12]. p. 1–12. Available from: http://link.springer.com/10.1007/978-3-319-67858-0_1

2. Korzeniewski SJ, Slaughter J, Lenski M, Haak P, Paneth N. The complex aetiology of cerebral palsy. Nat Rev Neurol. 2018 Sep;14(9):528–43.

3. Michael-Asalu A, Taylor G, Campbell H, Lelea L-L, Kirby RS. Cerebral Palsy. Advances in Pediatrics. 2019 Aug;66:189–208.

4. Schmidt SM, Hägglund G, Alriksson-Schmidt AI. Bone and joint complications and reduced mobility are associated with pain in children with cerebral palsy. Acta Paediatr. 2020 Mar;109(3):541–9.

5. Oskoui M, Coutinho F, Dykeman J, Jetté N, Pringsheim T. An update on the prevalence of cerebral palsy: a systematic review and meta-analysis. Dev Med Child Neurol. 2013 Jun;55(6):509–19.

6. Al Salloum AA, El Mouzan MI, Al Omar AA, Al Herbish AS, Qurashi MM. The prevalence of neurological disorders in Saudi children: a community-based study. J Child Neurol. 2011 Jan;26(1):21–4.

7. el Rifai MR, Ramia S, Moore V. Cerebral palsy in Riyadh, Saudi Arabia: II. Associations between gestational age, birthweight and cerebral palsy. Ann Trop Paediatr. 1984 Mar;4(1):13–7.

8. Graham HK, Rosenbaum P, Paneth N, Dan B, Lin J-P, Damiano DL, et al. Cerebral palsy. Nat Rev Dis Primers. 2016 Dec;2(1):15082.

9. Chikwanha TM, Chidhakwa S, Dangarembizi N. Occupational therapy needs of adolescents and young adults with cerebral palsy in Zimbabwe: caregivers' perspectives. Cent Afr J Med. 2015 Aug;61(5–8):38–44.

10. Kruijsen-Terpstra AJA, Ketelaar M, Boeije H, Jongmans MJ, Gorter JW, Verheijden J, et al. Parents' experiences with physical and occupational therapy for their young child with cerebral palsy: a mixed studies review. Child Care Health Dev. 2014 Nov;40(6):787–96.

11. Gmelig Meyling C, Ketelaar M, Kuijper M-A, Voorman J, Buizer AI. Effects of Postural Management on Hip Migration in Children With Cerebral Palsy: A Systematic Review. Pediatr Phys Ther. 2018 Apr;30(2):82–91.

12. Ravi DK, Kumar N, Singhi P. Effectiveness of virtual reality rehabilitation for children and adolescents with cerebral palsy: an updated evidence-based systematic review. Physiotherapy. 2017 Sep;103(3):245–58.

13. Mohamed Madi S, Mandy A, Aranda K. The Perception of Disability Among Mothers Living With a Child With Cerebral Palsy in Saudi Arabia. Global Qualitative Nursing Research. 2019 Jan;6:233339361984409.

14. Almuneef AR, Almajwal A, Alam I, Abulmeaty M, Bader BA, Badr MF, et al. Malnutrition is common in children with cerebral palsy in Saudi Arabia – a cross-sectional clinical observational study. BMC Neurol. 2019 Dec;19(1):317.

15. Soliman R, Altwairqi R, Alshamrani N, Al-Zahrani A, Al-Towairqi R, Al-Habashi A. Relationship between quality of life of children with cerebral palsy and their mothers' depression and anxiety. Saudi J Health Sci. 2019;8(1):1.

16. Toro ML, Eke C, Pearlman J. The impact of the World Health Organization 8-steps in wheelchair service provision in wheelchair users in a less resourced setting: a cohort study in Indonesia. BMC Health Serv Res. 2015 Dec;16(1):26.

17. Ekiz T, Özbudak Demir S, Sümer HG, Özgirgin N. Wheelchair appropriateness in children with cerebral palsy: A single center experience. BMR. 2017 Aug 3;30(4):825–8.

18. Hodgkinson I, Jindrich ML, Duhaut P, Vadot JP, Metton G, Bérard C. Hip pain in 234 non-ambulatory adolescents and young adults with cerebral palsy: a cross-sectional multicentre study. Dev Med Child Neurol. 2001 Dec;43(12):806–8.

19. Newman CJ, Holenweg-Gross C, Vuillerot C, Jeannet P-Y, Roulet-Perez E. Recent skin injuries in children with motor disabilities. Arch Dis Child. 2010 May;95(5):387–90.

20. Alkhateeb AM, Daher NS, Forrester BJ, Martin BD, Jaber HM. Effects of adjustments to wheelchair seat to back support angle on head, neck, and shoulder postures in subjects with cerebral palsy. Assistive Technology. 2019 Jul 24;1–7.

21. Khasnabis C, Mines K, Organization WH. Wheelchair service training package: intermediate level. World Health Organization; 2013.

22. Rodby-Bousquet E, Hägglund G. Use of manual and powered wheelchair in children with cerebral palsy: a cross-sectional study. BMC Pediatr. 2010 Aug 16;10:59.

23. Al-Owesie RM, Moussa NM, Robert AA. Anxiety and depression among traumatic spinal cord injured patients. Neurosciences. 2012;17(2):145–50.

24. Ibrahim FM. The Effect of Self-Management Telecare Educational Program on Knowledge, Attitude and Practice among Saudi Type-2 Diabetic Patients at Sultan Bin Abdulaziz Humanitarian City ،Kindom of Sudia Arabia (2015-2017) [PhD Thesis]. University of Gezira; 2018.

25. SBAHC. Sultan Bin Abdulaziz Humanitarian City [Internet]. 2020 [cited 2020 Dec 15]. Available from: http://humanitariancity.org.sa:80/en-us/AboutUs/Pages/About-us.aspx

26. Alanazi F, Alotaibi K, Almutlaq F, Aldahash A, Alsenani A. Awareness of adult population toward palpitation and its risk factors in Riyadh region, Saudi Arabia. IJMDC. 2020;383–8.

27. Ghotbi N, Ansari NN, Naghdi S, Hasson S, Jamshidpour B, Amiri S. Inter-rater reliability of the Modified Modified Ashworth Scale in assessing lower limb muscle spasticity. Brain Injury. 2009 Jan;23(10):815–9.

28. Germanotta M, Gower V, Papadopoulou D, Cruciani A, Pecchioli C, Mosca R, et al.

Reliability, validity and discriminant ability of a robotic device for finger training in patients with subacute stroke. J Neuroeng Rehabil. 2020 Jan 3;17(1):1.

29. Abolhasani H, Ansari NN, Naghdi S, Mansouri K, Ghotbi N, Hasson S. Comparing the validity of the Modified Modified Ashworth Scale (MMAS) and the Modified Tardieu Scale (MTS) in the assessment of wrist flexor spasticity in patients with stroke: protocol for a neurophysiological study. BMJ Open. 2012;2(6).

30. Hatta T, Nishimura S, Inoue K, Yamanaka M, Maki M, Kobayashi N, et al. Evaluating the relationships between the postural adaptation of patients with profound cerebral palsy and the configuration of the Seating Buggy's seating support surface. J Physiol Anthropol. 2007 Mar;26(2):217–24.

31. Frank AO, De Souza LH. Problematic clinical features of children and adults with cerebral palsy who use electric powered indoor/outdoor wheelchairs: A cross-sectional study. Assistive Technology. 2017 Apr 3;29(2):68–75.

32. Shirogane S, Handa T, Kozai Y, Maeda Y. A preliminary study of the measurement of overload applied to the foot support of a wheelchair and a seated postural support device. J Phys Ther Sci. 2017 Jan;29(1):8–11.

33. Liu W, Chen F, Lin Y, Kuo C, Lien H, Yu Y. Postural alignment in children with bilateral spastic cerebral palsy using a bimanual interface for powered wheelchair control. J Rehabil Med. 2014;46(1):39–44.

34. McDonald R, Surtees R. Changes in postural alignment when using kneeblocks for children with severe motor disorders. Disability and Rehabilitation: Assistive Technology. 2007 Jan;2(5):287–91.

35. Vekerdy Z. Management of seating posture of children with cerebral palsy by using thoracic-lumbar-sacral orthosis with non-rigid SIDO® frame. Disability and Rehabilitation. 2007 Jan;29(18):1434–41.

36. Waddington H, Aloe AM, Becker BJ, Djimeu EW, Hombrados JG, Tugwell P, et al. Quasi-experimental study designs series-paper 6: risk of bias assessment. J Clin Epidemiol. 2017 Sep;89:43–52.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 2, 2021, Pages. 4316- 4326
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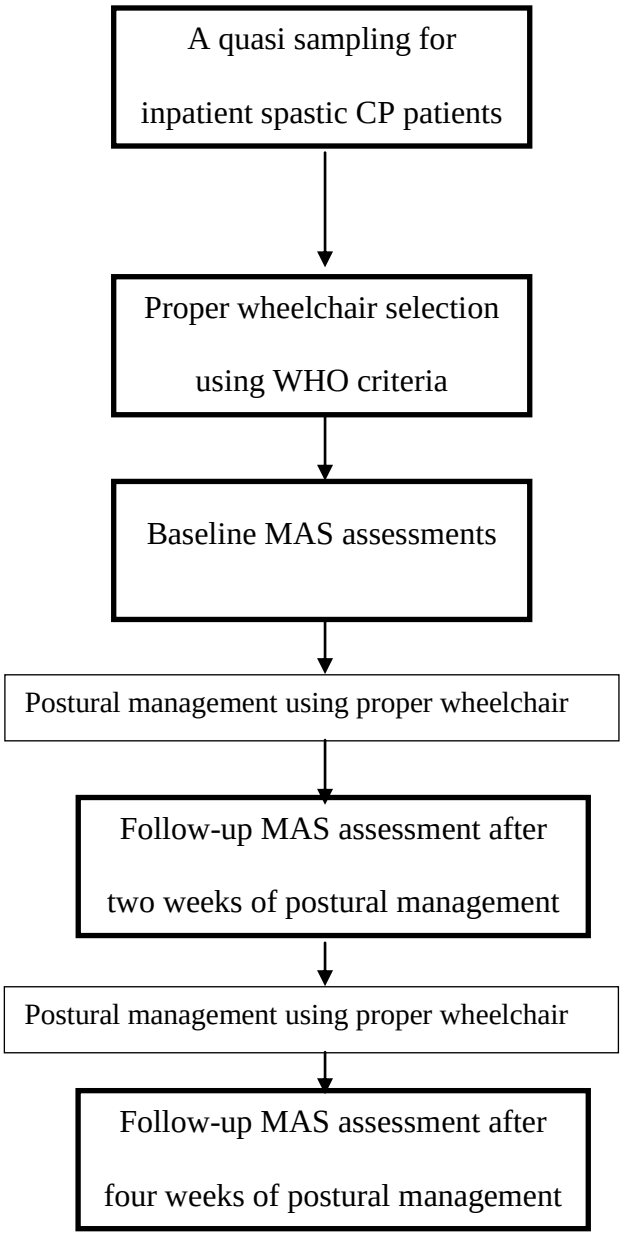

Figure 1: Data Collection Flowchart

Table 1. Socio-Demographic Characteristics of Study Subjects and type of provided wheelchair (n=35).

Variable	Number	Percent
Age (mean (years)± SD = 8.0 ± 2.7)		
4 – 6 year	12	34.3
7 – 9 year	12	34.3
10+ year	11	31.4

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Gender		
Male	18	51.4
Female	17	48.6
Type of wheelchair that was provided to the child		
Standard wheelchair	16	45.7
Active wheelchair	12	34.3
Push wheelchair	7	20

able 2. The Modified Ashworth Scale (MAS) Score of Study Subjects pre, during, and post postural management using a proper wheelchair (n=35).

Joint	Mean score			p-value*
	Baseline MAS	MAS after 2 wks	MAS after 4 wks	
Right Shoulder	2.7 ±0.82	2.7 ±0.82	2.1 ±1.07	<0.001**
Left Shoulder	2.7 ±0.82	2.7 ±0.82	2.1 ±1.05	<0.001**
Right Elbow	2.7 ±0.82	2.7 ±0.82	2.1 ±1.07	<0.001**
Left Elbow	2.7 ±0.82	2.7 ±0.82	2.1 ±1.05	<0.001**
Right Wrist	2.7 ±0.82	2.7 ±0.82	2.1 ±1.07	<0.001**
Left Wrist	2.7 ±0.82	2.7 ±0.82	2.1 ±1.05	<0.001**
Right Hip	2.7 ±0.82	2.7 ±0.82	1.9 ±0.83	<0.001**
Left Hip	2.7 ±0.82	2.7 ±0.82	2.0 ±0.84	<0.001**
Right Knee	2.7 ±0.82	2.7 ±0.82	2.7 ±0.86	0.324
Left Knee	2.7 ±0.82	2.7 ±0.82	2.7 ±0.82	-
Right Ankle	2.7 ±0.82	2.7 ±0.82	2.7 ±0.86	0.324
Left Ankle	2.7 ±0.83	2.7 ±0.83	2.7 ±0.83	-

* Paired sample t-test (baseline and after 4 weeks), ** Significant p-value