



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 3, March 2023

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423

 9940 572 462

 6381 907 438

 [ijirset@gmail.com](mailto:ijirset@gmail.com)

 [www.ijirset.com](http://www.ijirset.com)

# Semi Automatic Electric Support Walker for Cerebral Palsy Patients

M.Sweetline Sonia, M.E, N.Nafees Hussain, S.Nagaraj, S.Sakthivel, V.A.Sridhar Balan

Assistant Professor, Department of ECE, Mahendra Engineering College, Mahendhirapuri, Mallasamudram, Namakkal Dt, India

Department of ECE, Mahendra Engineering College, Mahendhirapuri, Mallasamudram, Namakkal Dt, India

**ABSTRACT:** Injury to the developing brain before, during, and after birth causes various symptoms to evolve in a child; the condition is referred to as cerebral palsy. It affects the normal movement in different parts of the body along with problems such as abnormal resistance to movements, the attitude of the body, and movement and activity limitation, accompanied by various sensory disturbances along with perception, cognition, communication, behavior, epilepsy, and secondary musculoskeletal problems. The causes may be prenatal, perinatal, and postnatal. Certain risk factors are identified for damaging the brain that also include the health condition of the mother before conception. The prevalence of CP is found to be stable in various epidemiological studies owing to different preventative, neonatal care, and postnatal strategies. Brain damage during the developing period or immediately after birth can be detected by gathering information from the mother during events that have occurred before or during delivery and certain early signs in the child. Diagnostic tools are now available for the detection of cerebral palsy as early as less than 5 months. Based on the heterogeneity of the condition, various associated problems arise in the child along with motor disturbances which need to be assessed and managed by a multidisciplinary team of specialists.

## I. INTRODUCTION

Cerebral Palsy (CP) is the most prevalent diagnosis for children with significant motor impairments who are followed by physical and occupational therapists [1]. This diagnosis results in lifelong progressive deforming secondary sequellae, most likely as a direct result of immobility. One of the newest revealed pressing issues is that change in muscle physiology including the loss of stem (satellite) cells and increase in collagen and muscle stiffness may be a result of non-use [2].

The Gross Motor Function Classification System (GMFCS) [3] classifies children with CP according to their mobility level and need for assistive devices. Children classified as GMFCS levels IV and V are unable to walk with hand-held walkers due to lack of trunk/postural control, strength, range of motion (ROM) and balance. These children require more supportive walkers that provide additional trunk and pelvic support, as well as unweighting. These types of walkers are often referred to as gait trainers, but the term support walker is also found in the literature [4]. Following onset of independent ambulation, children at GMFCS levels I–III are unlikely to use gait trainers except for activities that are enhanced by a device that is hands-free and/or offers increased postural support with or without body weight support. The use of a gait trainer may be one methodology to increase activity and muscle use and thus decrease contracture and disuse weakness for children at GMFCS levels IV and V.

A recent systematic review of outcomes of gait trainer use in children [5] identified mainly descriptive evidence supporting a positive impact on walking distance, mobility level and ability to take steps. Some studies suggested a positive impact on bone mineral density and bowel function along with a variety of activity and participation outcomes, but overall the evidence was low level and strong conclusions could not be reached. This review identified a limited number of clinical measurement tools that have been used to evaluate impact of gait trainer interventions for children. The review suggests that lack of reliable sensitive outcome measures may be a factor contributing to lack of stronger intervention research in this area. However, outcome measurement was not the focus of this previous paper and no critical appraisal of the tools was conducted.

The purpose of this review is to summarize the clinical measurement tools available to assess outcomes relevant to children with CP who are functioning at GMFCS IV and V as these are primarily the population of children who are using gait trainers; to critically appraise the psychometric properties of these tools and to identify which International Classification of Functioning, Disability and Health (ICF) [6,7] domains they address. We defined a gait trainer as a walker that provides additional trunk and pelvic support and is designed to be used in typical home or school settings.

Our specific clinical question was “For children aged 18 years or younger, with CP, what clinical measurement tools have been used to assess gait trainer outcomes; what additional clinical measurement tools may be appropriate for this intervention and population; what are their psychometric properties; and which ICF domains do they address?”

## II. BACKGROUND

Support walkers are a type of assistive device that may enable non-ambulant children with disabilities to walk independently and promote improvements in bowel function, bone mineral density (BMD), mobility, independence, participation and social function. However, there is little evidence to support these benefits and there is a lack of research describing the use of support walkers in clinical practice. This study aimed to examine the use of support walkers for children with disabilities in clinical practice.

Support walkers may enable non-ambulant children the opportunity to walk independently. In a systematic review, several studies found positive changes across all dimensions of the International Classification of Functioning, Disability and Health [7], following use of support walkers including bowel function, bone mineral density (BMD), mobility, independence, participation and social function, with minimal adverse events [5]. However, the same systematic review suggested that the evidence was scarce, of low quality and inconsistent [5]. It was also noted that most of the current research focuses on children under 12 years of age with cerebral palsy [5], despite the potential of these devices in numerous other medical conditions [6]. Studies varied in terms of the protocol used and the outcomes assessed, thus limiting the conclusions that may be used to inform best practice.

While some studies have investigated the effectiveness of support walkers on a variety of outcomes, there is a lack of research examining how support walkers are currently used for children with disabilities in clinical practice. While one study has described the use of support walkers among children with disabilities in the United States [6], the study did not fully explore the perceived benefits, problems and reason to discontinue use of support walkers. Before further evaluating effectiveness of support walkers, information regarding the population who are prescribed support walkers, when and how they are used in routine clinical practice, and the perceived benefits and problems of using support walkers, is needed [8].

## III. METHODS

We built on the search that was completed for the systematic review [5] and updated it in January 2016. Databases included CINAHL; Medline; EMBASE; and EBM Reviews. Search terms included “gait trainer”, “supported walking”, “support walker”, “walking device”, “body weight support gait trainer”, “walker”, “supported ambulation” and “David Hart Walker”. Articles from the systematic review [5] were included if they provided a description of the clinical tools used and information on reliability, validity and/or clinical utility. We defined a clinical tool as one that could be used by a physical or occupational therapist in a family home or community, school or typical therapeutic setting. We specifically searched for tools that could be used for evaluative purposes rather than those designed to classify level of disability or discriminate between children with and without disabilities or delays. Outcome measures that require specialized medical or hospital-based equipment and are not able to be completed in a typical clinical environment were excluded, e.g., X-ray, bone mineral density scans, specialized gait analysis, etc. We included questionnaire-type assessments describing typical performance and designed to be completed by child or parent-proxy report. Capacity assessments completed by professional observation could include observation of physical abilities in real time or reviewing later via video-taping. Tempo-spatial measures could include use of a measuring tape or wheel, and stop-watch or video-camera, but would exclude specialized gait analysis that would require a gait lab setting or specialized camera or computer technology to complete. We excluded studies that did not provide detail on the clinical measurement tools or information on their psychometric properties.

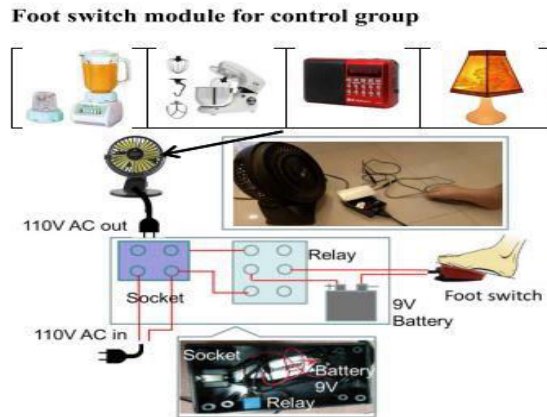


Fig 1: BLOCK DIAGRAM

Injury in the brain may cause disturbances in hand functioning which may be unilateral or bilateral. In the former case, motor control and function on one side of the body are affected. In this type of CP, children experience difficulties using their hands on the affected side. Constraint-induced movement therapy (CIMT) is a technique that is being used to improve the function of the affected hand. It is based on the principles that not using the good hand and intensive use of the affected hand improves hand function by neuroplasticity of the brain. A study reveals that the therapeutic effect of CIMT is independent of age. No differences were found between boys and girls for this therapy. CIMT is found to be effective in the literature to improve hand function; however, its effect on muscle tone and protective extension is yet to be investigated.

### III. RESULT ANALYSIS WALKING

Information about the study was shared with 33 Special Educational Needs (SEN) schools, 9 professional organisations and 10 charities for young people with disabilities in the UK. These were identified via an internet search. Emails were sent and replies were received from eight UK organisations and charities for children with disabilities (e.g., the Association of Paediatric Chartered Physiotherapists) and eight SEN schools. Gatekeepers who worked in each organisation (e.g. an administrator, a physiotherapist, a principal) distributed a brief description of the study and link to the information sheet and survey via email or social media. One school was provided with paper versions of the survey and information sheet to distribute at their request.

(and supported/assisted stepping) remains a primary long-term goal for parents of children with CP, despite the fact that their children often see walking as exercise rather than functional mobility [79]. Many of the outcomes measured in gait trainer research focus on increasing number of steps, increasing walking speed or endurance, or quality of stepping.

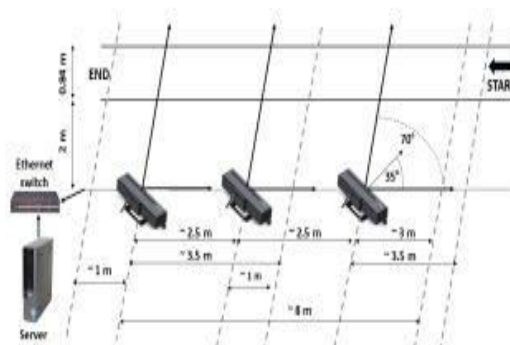


Fig 2:

provides a summary of the clinical utility of all the measures identified in this review. Clinical utility was rated using the McMaster Outcome Measures rating form and includes consideration of the clarity of the instructions, format, time needed to complete, need for specialized training or equipment, availability of the measure and instruction manual as well as cost. Consideration of usefulness for children using gait trainers would also include whether or not the measure can be used with the child in the gait trainer or not. Excellent overall utility indicates that the tool has adequate to excellent clinical utility, is easily available and has excellent reliability and validity. Adequate overall utility indicates that the tool has adequate to excellent clinical utility, is easily available and has adequate to excellent reliability and validity. Poor overall utility indicates that the tool has poor clinical utility for this population or intervention, is not easily available or has poor reliability and validity. A poor score in any of these factors would result in an overall score of poor overall utility.

#### IV. CONCLUSION

This narrative review summarizes the latest advances in cerebral palsy and identifies where more research is required. Several studies on cerebral palsy were analyzed to generate a general idea of the prevalence of, risk factors associated with, and classification of cerebral palsy (CP). Different classification systems used for the classification of CP on a functional basis were also analyzed. Diagnosis systems used along with the prevention techniques were discussed. State-of-the-art treatment strategies for CP were also analyzed. Statistical distribution was performed based on the selected studies. Prevalence was found to be 2-3/1000 lives; the factors that can be correlated are gestational age and birth weight. The risk factors identified were preconception, prenatal, perinatal, and postnatal categories. According to the evidence, CP is classified into spastic (80%), dyskinetic (15%), and ataxic (5%) forms. Diagnosis approaches were based on clinical investigation and neurological examinations that include magnetic resonance imaging (MRI), biomarkers, and cranial ultrasound. The treatment procedures found were medical and surgical interventions, physiotherapy, occupational therapy, umbilical milking, nanomedicine, and stem cell therapy. Technological advancements in CP were also discussed.

#### REFERENCES

1. Hanna, S.E.; Bartlett, D.J.; Rivard, L.M.; Russell, D.J. Reference curves for the Gross Motor Function Measure: Percentiles for clinical description and tracking over time among children with cerebral palsy. *Phys. Ther.* **2008**, *88*, 596–607. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)]
2. Dayanidhi, S.; Dykstra, P.B.; Lyubasyuk, V.; McKay, B.R.; Chambers, H.G.; Lieber, R.L. Reduced satellite cell number in situ in muscular contractures from children with cerebral palsy. *J. Orthop. Res.* **2015**, *33*, 1039–1045. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)]
3. Palisano, R.; Rosenbaum, P.; Walter, S.; Russell, D.; Wood, E.; Galuppi, B. Development and reliability of a system to classify gross motor function in children with cerebral palsy. *Dev. Med. Child Neurol.* **1997**, *39*, 214–223. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)]
4. Low, S.A.; McCoy, S.W.; Beling, J.; Adams, J. Pediatric physical therapists' use of support walkers for children with disabilities: A nationwide survey. *Pediatr. Phys. Ther.* **2011**, *23*, 381–389. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)]
5. Paleg, G.; Livingstone, R. Outcomes of gait trainer use in home and school settings for children with motor impairments: A systematic review. *Clin. Rehabil.* **2015**, *28*, 1077–1091. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)]
6. World Health Organization. *International Classification of Functioning, Disability & Health (ICF)*; World Health Organization: Geneva, Switzerland, 2001. [[Google Scholar](#)]
7. World Health Organization. *International Classification of Functioning, Disability and Health—Children and Youth*; World Health Organization: Geneva, Switzerland, 2007. [[Google Scholar](#)]
8. Chung, J.; Evans, J.; Lee, C.; Rabbani, Y.; Roxborough, L.; Harris, S.R. Effectiveness of adaptive seating on sitting posture and postural control in children with cerebral palsy. *Pediatr. Phys. Ther.* **2008**, *20*, 303–317. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)]
9. Livingstone, R.; Field, D. Systematic review of power mobility outcomes for infants, children and adolescents with mobility limitations. *Clin. Rehabil.* **2014**, *28*, 954–964. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)]
10. Houwen, S.; Van der Putten, A.; Vlaskamp, C. A systematic review of the effects of motor interventions to improve motor, cognitive, and/or social functioning in people with severe or profound intellectual disabilities. *Res. Dev. Disabil.* **2014**, *35*, 2093–2116. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)]
11. Zwicker, J.G.; Mayson, T.A. Effectiveness of treadmill training in children with motor impairments: An overview of systematic reviews. *Pediatr. Phys. Ther.* **2010**, *22*, 361–377. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)]



12. Sakzewski, L.; Boyd, R.; Ziviani, J. Clinimetric properties of participation measures for 5 to 13 year old children with cerebral palsy: A systematic review. *Dev. Med. Child Neurol.* **2007**, *49*, 232–240. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)]
13. Field, D.; Livingstone, R. Clinical tools that measure sitting posture, seated postural control or functional abilities in children with motor impairments: A systematic review. *Clin. Rehabil.* **2013**, *27*, 994–1004. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)]
14. Field, D.A.; Miller, W.C.; Ryan, S.E.; Jarus, T.; Abundo, A. Measuring participation for children and youth with power mobility needs: A systematic review of potential health measurement tools. *Arch. Phys. Med. Rehabil.* **2015**, *97*, 462–477. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)]
15. Law, M. Outcome Measures Rating Form Guidelines. Available online: <http://www.canchild.ca/en/canchildresources.resources.measguid.pdf> (accessed on 7 May 2016).



**INNO SPACE**  
SJIF Scientific Journal Impact Factor  
**Impact Factor: 8.118**



**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details