A Systematic Review of Assistive Technology Devices to Promote Independent Living in Children with Cerebral Palsy

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Abstract. The purpose of this paper is to provide an overview of the requirements for assistive technology (AT) devices for children with cerebral palsy (CP) in Malaysia. It also presents how prior and current research on AT devices can help children with CP become more self-reliant in their daily lives. This research was conducted using databases such as Google Scholar, Science Direct, the official portal of the Ministry of Health Malaysia, as well as the Cerebral Palsy Research Network, Nemours KidsHealth, CerebralPalsy.org, United Cerebral Palsy, and the National Institute of Child Health and Human Development. Articles from 2001 to 2020 were reviewed, and only 46 sources out of 80 were reliable.

Keywords: systematic review, cerebral palsy, assistive technology devices, improving self-care, adaptive skills

1 Introduction

Children with CP experienced motor delays affecting body movement and coordination that restricted their movement. Besides that, they also faced difficulties in performing certain daily activities. The brain malfunction in CP can also cause health issues such as learning disabilities and vision, hearing, and speech problems. The injury often occurred before birth, sometimes during delivery or soon after the baby is born [1]. Usually, children are diagnosed with CP problems within the first five years of their life. Infants with CP are slow to reach developmental milestones such as learning to roll over, sit, crawl, smile, or walk. CP can be mild, moderate, or severe in its category. Mild CP shows an indication that the child is clumsy. For moderate CP, the child walks with a limp, and the child might need a special leg brace or a cane. A more severe CP can affect all parts of the child's physical abilities. The varieties of CP depend on motor types, as depicted in Figure 1.

[1] Ismawi bin Ismail. Perawatan Fisioterapi untuk pesakit palsi serebral. Portal Myhealth, Kementerian Kesihatan Malaysia.

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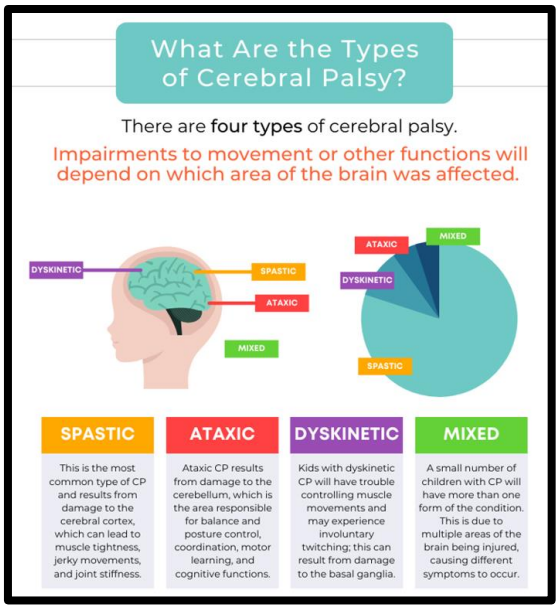

Figure 1: The Types of CP Based on Motor Types
(https://www.berestonlaw.com)

Although there is no definitive cure for children with CP, some treatment options include surgery, therapies such as physical therapy, occupational therapy, and speech therapy, as well as special equipment that can help and improve the condition of children with CP [2]. The major purpose of using AT devices according to [3] is to develop and instruct the muscles to move in harmony with the brain activity. Children with CP should undergo treatment and training at a therapy centre and continue at home to train the brain and body to function simultaneously. The majority of children with CP require AT devices to improve their posture and enable them to become self-sufficient. Allowing them to sit in an improper position for an extended period can result in spinal deformities, muscle shortening, joint spasms, and hip joint dislocation or subluxation [4]. If early detection and intervention are offered to disabled children, they will have a better chance of reaching a higher quality of life [5] and [6] improve the long-term outcomes and family well-being. AT devices development, on the other hand, must be tailored to the demands of children with CP as well as their surrounding conditions.

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[2] *Nemours KidsHealth. Cerebral Palsy (for Parents) - https://kidshealth.org/en/parents/cerebral-palsy.html?*
[3] United Cerebral Palsy. *Assistive Technology.* https://ucp.org/resource-guide/assistive-technology/
[4]Zainudin bin Satar. *Pengendalian Kanak-kanak Cerebral Palsy*. PORTAL Myhealth, Kementerian Kesihatan Malaysia.
[5] Tan KL, Yadav H. Assessing the development of children with disability in Malaysia. Med J Malaysia. 2008 Aug;63(3):199-02. PMID: 19248689.
[6] Amar, H. S. S. Meeting the needs of children with disability in Malaysia. Med J Malaysia, 63(1), 1.

As a result, this article focuses on the requirements of AT devices for children with CP in Malaysia. The use of AT devices by children with CP can help them in developing adaptive skills and fostering self-reliance in their daily lives.

2 Past Experience in Developing Special Aids for Children with CP

For the Corporate Social Responsibility–Innovation Project at Polytechnic Sultan Salahuddin Abdul Aziz Shah (PSA) in 2012, we started a project to develop special aids for children with CP. It was a collaboration between PSA and the Faculty of Health Sciences, Universiti Kebangsaan Malaysia (UKM). This project was funded by an internal grant from PSA's Centre of Technology (CoT) and supported by Malaysian Advocates for Cerebral Palsy (Mycp), a network for the parents of children with CP. For the first project, we designed and built a special chair for children with CP. Depending on the patient's needs, we developed six different CP chair designs. We started our second project in 2015 by building a standing aid to help children with CP to stand on their own. This project is still ongoing after receiving the Technical Applied Research Grant (TARGS) from the Department of Polytechnic and Community Colleges in 2020 and will end in August 2021. Based on our experience in designing particular aids for children with CP, we are determined that more AT devices and information about the patients are required. During this study, we interviewed medical doctors, occupational therapists, physiotherapists, and parents who cared for children with CP as our contextual review. Figures 2.0 and 2.1 show the prototype.

Figure 2.0: Prototype of CP Chair

Figure 2.1: Prototype of Standing Frame

3 Materials and Methods

This study has systematically searched the databases: Google Scholar, Science Direct, and the official website of Ministry of Health Malaysia, Cerebral Palsy Research Network, Nemours KidsHealth, CerebralPalsy.org, United Cerebral Palsy, and National Institute of Child Health and Human Development. The articles from 2001 until 2020 were reviewed. From 80 sources, only 46 sources fulfilled the selection criteria. The databases were recruited using keywords search for "cerebral palsy", "cerebral palsy in Malaysia", "assistive technology", "assistive technology device", "types of assistive technology", "special aids", "improving self-care" and "adaptive skills". The search strategies were applied with the initial findings imported and integrated into Mendeley Desktop. After eliminating duplicates, the remaining titles and abstracts were reviewed for inclusion. Full texts were extracted and manually assessed from relevant articles. Systematic literature review (SLR) is one of the research methods to collect findings from other case studies.

4 Results

4.1 Cerebral Palsy in Children

In designing a product design or special aid for children with CP, the designer should understand the patient first. Thus, the following information were retrieved for this purpose.

Cerebral Palsy in Children	
Who is affected by CP?	Children with CP have one of the highest rates of long-term impairment. A study by [7] revealed CP affected 2 to 2.5 out of 1,000 babies, but [8] claimed that CP affected 1 to 2 out of 1,000 babies.
What is CP?	Although there are numerous definitions of CP, the majority of them defined it as a collection of issues that impact body mobility and posture. It is linked to a traumatic brain injury or developmental issues with the brain. CP is characterised by seizures that disrupt sensation, communication, perception, and behaviour [8].
The effect of CP	Body movement, muscular control, coordination, muscle tone, reflexes, posture, and balance are examples of physical disability affected by CP. Fine motor skills, gross motor skills, and oral motor functioning can be impacted. In the developing child, CP has an effect on the neurological, motor, and postural impairments [8]. The majority of children with CP have moderate to severe developmental delay affecting all skill areas. Some children with CP walk with a limp or have difficulty walking. Others may have limited or no control over their arms and legs or other body parts. They may struggle to control their mouth and tongue, which has an impact on eating and speaking. Seizure and intellectual disabilities are more common in those with severe forms of CP [9].
Treatment for children with CP	CP is incurable, and the child will probably need lifelong care. However, treatments can aid in the management of symptoms, prevention of issues, and enhancement of the child's abilities. One of the most important treatments is physical therapy. Other than that, medicines, surgery, and specialised equipment like a special chair, parallel bars, standing equipment, walker, and transfer aids can be beneficial [9].
The Types of CP Based on Motor Types and Function	
Signs of CP	According to [10], CP signs are frequently discovered before the child reaches the age of two and severe cases as early as three months of age. The symptoms vary, ranging from unrealistic awkwardness to severe malformation of the hands and feet, which requires the child to use a wheelchair. The four basic forms of CP are listed in Table 1 as an overview. Table 1: The Four Basic Forms of CP Based on Motor Types and Function

[7] Pellegrino, L. Cerebral palsy. In ML Batshaw et al., eds., Children with Disabilities, 6th ed., pp. 387–408.
[8] Khoo Peng Chuan.Cerebral Palsy. MyHealth Portal, Ministry of Health Malaysia.
[9] Pellegrino, L. Cerebral palsy. In ML Batshaw et al., eds., Children with Disabilities, 6th ed., pp. 387–408.
[10] Khoo Peng Chuan.Cerebral Palsy. MyHealth Portal, Ministry of Health Malaysia.

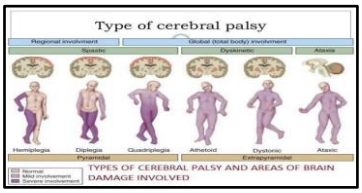
<table>
<tr><td></td><td>
<table>
<tr><th>The types of CP</th><th>Affected by CP</th></tr>
<tr><td>a. Spastic type (65% of all CP cases)</td><td>-muscles become tense and weak
-Common involvement can be divided into:
(i) Quadriplegia: both hands and feet
(ii) Diplegia: both feet
(iii) Hemiplegia: hands and feet on one</td></tr>
<tr><td>b. Dyskinetics type (athetoid/dystonia/choreoathetosis 10% of all CP cases)</td><td>-affected the hand, foot and body muscles spontaneously moving slowly, squirming and uncontrolled
-but sometime it is also common to have rough and convulsive movements.</td></tr>
<tr><td>c. Ataxic type (5% of all CP cases),</td><td>-consists of vibrations, shaky steps with both feet apart, a balance disorder that causes the movement of the feet and hands is not smooth.</td></tr>
<tr><td>d. Mixed Types (20% of all CP cases),</td><td>-combination of the 2 types above, which are often found to be a combination of spastic and dyskinetic types</td></tr>
</table>
(Notes: Khoo Peng Chuan. Cerebral Palsy. MyHealth Portal, Ministry of Health Malaysia)
</td></tr>
<tr><td>Spastic and non-spastic CP</td><td>One can be spastic or non-spastic when it comes to motor functions. Spastic CP occurs when the muscle tone increases or also known as hypertonia, but non-spastic CP occurs when the muscle tone fluctuates or decreases often referred to as hypertonia. Muscle tone is required for muscle contraction and relaxation as well as muscle coordination. Spastic CP patients' muscles are constantly contracting [11]. As a result, the limbs tighten up and become difficult to move. Even if movements exist, they are erratic and jerky.</td></tr>
<tr><td colspan="2">Classification of CP Based on Affected Body Part</td></tr>
<tr><td>Classification of CP</td><td>The classification of CP varies depending on the clinical presentation or activity limitations of the children with CP. The forms of CP and location of brain injury are shown in Figure 3.
 

Figure 3: The Types of Cerebral Palsy and Areas of Brain Damage
(grepmed.com)

Some are classified based on severity, topographical distribution, motor function, and the gross motor function classification system (GMFCS) according to [12]. In layman's term, topographical distribution relates to the affected body parts.</td></tr>
<tr><td>The classification</td><td>The classification of CP is based on the affected body part as shown in Table 2.</td></tr>
</table>

[11] *CerebralPalsy.org | Help, Resources for Children with CP*. (n.d.). Cerebralpalsy.Org. https://www.cerebralpalsy.org/

[12] *CerebralPalsy.org. Help, Resources for Children with CP*. (n.d.). Cerebralpalsy.Org. https://www.cerebralpalsy.org/

<table>
<tr><td>of CP based on the affected body part</td><td>Table 2: The Classification of CP Based on Affected Body Part<table><tr><th>Monoplegia or monoparesis)</th><th>Diplegia or diparesis</th><th>Quadriplegia or quadriparesis</th><th>Hemiplegia or hemiparesis</th><th>Paraplegia or paraparesis</th></tr><tr><td>-is referring to one part of the body is affected.</td><td>-is when the legs are affected more than the arms.</td><td>-is when all four limbs are affected.</td><td>-a vertical half of the body, meaning the arm and leg on one side of the body is affected.</td><td>- the lower half of the body, which includes both legs affected.</td></tr></table>(Notes: CerebralPalsy.org | Help, Resources for Children with CP. (n.d.). Cerebralpalsy.Org. https://www.cerebralpalsy.org/)</td></tr>
<tr><td colspan="2">The Importance of Postural Control in Children with CP</td></tr>
<tr><td>Importance of good posture</td><td>Good posture is important not only for an upright position but also for long-term health. The skeletal balance and symmetrical alignment of body segments are required for healthy posture from a biomechanical standpoint. Those who balance their body following the mechanical rules for human body systems (physics laws) are more upright [13]. Development of postural reactions, developmental integration of primitive reflexes, normal muscle tone, normal postural tone, and intentional voluntary movements are all part of postural control [14].</td></tr>
<tr><td>Benefits of proper seated placement</td><td>Tone, reflex activity, deformity avoidance, skin and tissue integrity preservation, postural stability, alignment, and function optimisation are all benefits of the proper seated placement. Furthermore, proper placement in adaptive seating can affect a child’s pulmonary function, speaking capacity, and overall lung health. Static postures, transitional movements, and functional mobility will be problematic for children with CP [15].</td></tr>
<tr><td rowspan="3">How does AT help posture control in children with CP?</td><td>While there is no specific treatment for CP, it can be controlled with AT that allows individuals to maintain a proper posture. An improper posture can result in long-term spinal deformities, hip joint dislocation, shortened muscles, and joint stiffness. The children are at risk of irreversible handicap if they do not place and maintain their bodies in a correct position [16].</td></tr>
<tr><td>Home intervention has been shown to relieve parents from the strain of everyday tasks for children with impairments, particularly CP youngsters. Parents and caregivers can assist children with impairments in their daily activities using posture control technology [17].</td></tr>
<tr><td>Dysfunctional postural control is a common problem in children with CP. Daily activities require postural control. Children with CP are frequently treated for postural issues.</td></tr>
</table>

[13]Engström, B. Ergonomic Seating a True Challenge Wheelchair Seating and Mobility Principles. Sweden: Posturalis Books.

[14] Wandel, JA. Positioning and Handling. In JW Solomon (Ed) *Pediatric Skill for Occupational Therapy Assistants*. London: Mosby

[15] Wescott, SL and Goulet, CG. Neuromuscular System: Structure, Functions, Diagnosis and Evaluation.

[16] Zainudin bin Satar. *Pengendalian Kanak-kanak Cerebral Palsy*. PORTAL MyHEALTH, Kementerian Kesihatan Malaysia.

[17] Ryan, S. E., Campbell, K. A., Rigby, P. J., Fishbein-Germon, B., Hubley, D., & Chan, B. The Impact of Adaptive Seating Devices on the Lives of Young Children with Cerebral Palsy and Their Families. *Archives of Physical Medicine and Rehabilitation*, *90*(1), 27–33. https://doi.org/10.1016/j.apmr.2008.07.011

	Although the benefits of therapy are mostly unknown, they are either partially or completely ineffective [18].
	Most functional actions require some degree of postural control; therefore, decreasing the capacity or inability to control posture is problematic [19].
	In the anterior-posterior and medial-lateral axes, children with CP walk with significant instability. They also walk with an unsteady gait [20].
	To develop effective therapeutic approaches for children with CP, researchers must have a better knowledge of the underlying mechanisms of postural control in these children. It is also important to focus on postural problems in a seated position [21].
	To establish and maintain the ideal posture and functional use of upper extremities, adaptive sitting supports for CP are indicated [22].
	Children with CP should be equipped with wheelchairs that have a slanted forward seat of 0°-15° to improve their upper extremity function, as well as a hip belt, an AO, footrests, and a cut-out tray. Individuals should determine their exact seat angle and orientation within the 0°-15° range [23].
	Thus, it can be concluded that the AT device can facilitate and improve the lives of children with CP. Designers must study the CP condition to innovate the right AT device.

4.2 Adaptation of Seat Design in AT Design Concept for Children with CP

According to [24], seating surfaces could be custom moulded, flat, or curved. Custom moulded seating can fit people with fixed abnormalities and give comfort. Moulding is also possible on the seat base, backrest, or both. A flat planar surface is better for those who need minimal support and it is the most basic of seat surface design. Contoured seating is the third seat surface design. The design must be based on the shape of the spine, buttocks, and thighs.

Furthermore, the contoured chair design provides better control and support by allowing the body to make more contact with the seating surface. Only one study is looking into its effectiveness [25]. They also looked at how a contoured foam seat affected children with neurological issues.

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[18] Van der Heide, J and Hadders-Algra, M (2005). Postural Muscle Dyscoordination in children with Cerebral Palsy, Neural Plasticity, Vol.12, Article ID 369896. https://doi.org/10.1155/NP.2005.197

[19] Hong C. Positioning for children with learning disabilities. British Journal of Therapy and Rehabilitation, 9, 443-446.

[20] Sjoerd M. Bruijn, Matthew Millard, Leen van Gestel, Pieter Meyns, Ilse Jonkers, Kaat Desloovere Gait stability in children with Cerebral Palsy, Research in Developmental Disabilities, Volume 34, Issue 5, Pages 1689-1699. https://www.sciencedirect.com/science/article/abs/pii/S0891422213000693

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[22] Sahinoğlu D, Coskun G, Bek N. Effects of different seating equipment on postural control and upper extremity function in children with cerebral palsy. Prosthet Orthot Int. 2017 Feb;41(1):85-94. doi: 10.1177/0309364616637490. Epub 2016 Jul 9. PMID: 27025243.

[23] Stavness, C. The Effect of Positioning for Children with Cerebral Palsy on Upper-Extremity Function, Physical & Occupational Therapy in Pediatrics, 26:3, 39-53. DOI: 10.1080/J006v26n03_04

[24] Wright-Ott, C. and Egilson, S. Mobility. In J Case-Smith (Ed) Occupational Therapy for Children. St Louis: Mosby.

[25] Washington K, Deitz JC, White OR and Schwartz, IS. The effects of a contoured foam seat on postural alignment and upper-extremity function in infants with neuro-motor impairments. Physical Therapy,

While seated on the moulded foam seat, all subjects showed a persistent improvement in postural alignment. Although no evidence of greater bilateral play was found, the qualitative data collected from parents revealed the perceived benefits of increased functional independence and improved social connection [26]. Custom contouring has several drawbacks, including restricted ability to allow individual growth, difficulty with transfers, and lack of dynamic qualities because the individual is supported in a constant posture. For children with growth concerns or a history of orthopaedic problems, a device with a dynamically changeable contoured back was proposed [27].

[28] defined human posture as the relationship between one or more body segments and their orientation in space. Patients with CP frequently exhibit a lack of head control. Adaptive seating systems (AdSSs) are part of the postural management approach for children with severe CP. AdSSs with trunk and hip support devices are shown to improve postural control and self-care at home [29].

According to studies by [30], the 90-90-90 position may be regarded as an ideal seated position from an ergonomic perspective. From an anatomical standpoint, [31] stated that the goal is to obtain orthopaedic maximal symmetry between the left and right sides of the body by avoiding obliquity, rotation, and posterior pelvic tilt by maintaining a neutral pelvis. Relaxation and comfort are two objectives of the seats [32]. According to [33], the 90-90-90 position lowers tone briefly when it is used as a resting posture. A study by [34] proposed the purpose of adapted seating is to provide external support at the angles required by an individual to attain an upright, secure, and functioning position rather than obtaining perfect symmetry.

4.3 The Importance of Anthropometric Data and Ergonomics Field to Develop Product Design for Children with CP

82(11), 1064-1076.

[26] Cook AM and Hussey SM. Seating systems as extrinsic enablers for assistive technologies. In Assistive Technologies Principles and Practice. St Louis: Mosby.

[27] Freney-Bailey D. Custom contoured seating: a pediatric lightweight system and an adjustable contoured back. Proceedings of the 21stInternational Seating Symposium.

[28] Siti Rasyidah Hamzah, Nor Aiman Nor Izmin, Giha Tardan, Abdul Halim Abdullah Design and Analysis of Adjustable Headrest for Total Body Involvement Cerebral Palsy. International Journal of Recent Technology and Engineering (IJRTE), 8(1), 3208-3211.

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[31] Lange ML. Focus on positioning philosophies. Occupational Therapy Practice, 6, 15-16.

[32] Fatimahwati Hamzah, Norshahanis Hashim, Mohd Fakhrul Azri Abdullah, Intan Suria. Standing Frame Development for The Needs of Children with Cerebral Palsy.

[33] Kangas KM. Seating for task performance; creating seating systems that allow weight-bearing, pelvic stability and mobility. Rehab Management: The Interdisciplinary Journal of Rehabilitation, (15), 54-56, 74.

[34] Minkel JL. Long term rehab: sitting outside of the box: clinicians need to let go of the 90/90/90 seating rule to explore more officious alternatives. Rehab Management – The Interdisciplinary Journal of Rehabilitation, 14, 50-51, 82.

Anthropometry data refers to human body measurement. The data will be employed in the product design due to human physical variation, particularly among children with disabilities. Considerations such as functionality and ergonomics must also be considered [35]. Anthropometric data can be valuable in ergonomics domains according to [36].

According to [37], human factors, often known as ergonomics, is a science that studies human-system interactions and a profession that uses theory, concepts, data, and methodologies to design in improving human well-being and total system performance. Ergonomics and the human factor must be considered jointly. Ergonomics is a discipline that focuses on design. But, studying by [38], claim that human factor is the main factor in ergonomic that affect the interaction between the object system and humans rather than ergonomists who create the systems. One of the most challenging aspects of the design is that several functional systems must fulfil all the human compatibility requirements. In other words, ergonomics produces a product that suits the users and their environmental conditions.

4.4 Assistive Technology for Promoting Adaptive Skills of Children with Cerebral Palsy

There are currently numerous definitions for assistive technology (AT). According to [39], [40], and [41], any gadget, piece of equipment, or product system that is utilised to increase, maintain, or improve the functional capacities of a disabled child is considered AT. The definition of AT is dissected in Figure 4.4. Depending on the patient's needs and conditions, AT devices range from simple to complicated technologies. AT items can be manufactured by hand, purchased, or modified from another product. The goal of developing AT device for children with impairments is to help them perform home-based activities and socialise with their peers.

Their developmental, functioning, and learning skills are also improved using AT [42]. A wide selection of equipment is available to help patients with their daily lives [43]. People who have trouble speaking, typing, writing, remembering, seeing, hearing, walking, and many other activities

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[35] Norfadlina Khalid, Hafizal Hazeri, Nik Mohd Azrir Nik Kamarudin Development of corner Chair with Exercise Device for Cerebral Palsy Children: Design Process and Ergonomic Consideration. Mimet technical Bulletin Volume 4 Edition 1.

[36] N. Wazir, M. Shanat, S. Mohamaddan. An anthropometric measurement of cerebral palsy children for developing product design. International Journal of Scientific and Technology Research, 8(12).

[37] Norfadlina Khalid, Hafizal Hazeri, Nik Mohd Azrir Nik Kamarudin Development of corner Chair with Exercise Device for Cerebral Palsy Children: Design Process and Ergonomic Consideration. Mimet technical Bulletin Volume 4 Edition 1.

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[40] *ATIA*. Assistive Technology Industry Association. https://www.atia.org

[41] Hess, J and Gutierrez, A.-M. Assistive Technology 101. Get Informed about Assistive technology for your child. Center on Technology and Disability. https://www.ctdinstitute.org/sites/default/files/file_attachments/CTD-AT101-V4.pdf

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[43] United Cerebral Palsy. *Assistive Technology.* https://ucp.org/resource-guide/assistive-technology/

can benefit from AT. Various disabilities necessitate the use of AT. People with impairments rely on AT to perform daily tasks and maintain their independence [44].

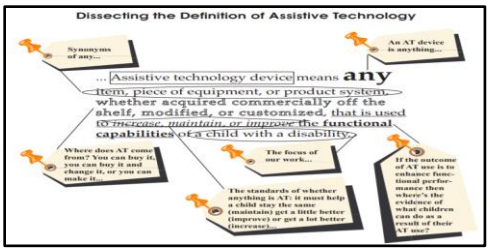

Figure 4.4: Dissecting the Definition of Assistive Technology
(http://citeseerx.ist.psu.edu/)

4.5 The Example of Assistive Technology and Its Uses

Many AT gadgets have been developed to assist people with disabilities, and some AT can be utilised by children with CP. Table 3 shows a list of AT equipment.

Table 3: The Example of Assistive Devices and Its Uses

Item	Assistive Technology	Uses of Assistive Technology
1.	**Mobility aids**	- such as wheelchairs, scooters, walkers, canes, crutches, prosthetic device and orthotic devices help children with CP to compensate for muscle imbalance and increase independent mobility. - Orthotics are an external support or brace worn or applied to the body; hand splint, lower limb cast, neck support or brace. - Some people living with disability will find that the use of orthotics will aid them in walking, standing, using their hands more effectively or positioning their body more comfortably.
2.	**Tools**	- such as automatic page turners, book holders, and adapted pencil grips to help learners with disabilities participate in educational activities
3.	**Physical modifications**	- Physical modification in the built environment, including ramps, grab bars, and wider doorways to enable access to buildings, businesses, and workplaces
4.	**Adaptive switches and utensils**	- to allow those with limited motor skills to eat, play games, and accomplish other activities. - There is a range of switches and mounting equipment available which support people living with a disability use a variety of electronic devices and other equipment in their everyday tasks. - Using the right switch or mounting device is important for ergonomics, visibility and accuracy of access as well as to prevent damage to the device from being dropped.

(Notes: National Institute of Child Health and Human Development. What Are Some Types of Assistive Devices and How Are They Used? https://www.nichd.nih.gov/health/topics/rehabtech/conditioninfo/device)

4.6 Standing Aid as one of AT devices for children with CP

[44] *ATIA*. Assistive Technology Industry Association. https://www.atia.org

Standing aid is a device that assists children with disabilities to stand up on their own. It also includes a leg-strengthening workout for the children. Although leg assistance can reduce the muscle activation of leg flexors and pelvic assistance tend to enhance muscle activation of hip abductors in children with CP, the application of a controlled pelvis assistance force can increase step height and a controlled leg assistance force can improve step length. It is similar to training using a treadmill [45].

According to [46], standing aid, or also known as a stand, a stander, a standing technology, a standing assistant, a standing device, a standing box, or a tilt table, is a piece of AT that can be used by someone who uses a wheelchair for mobility. By supporting the person in a standing position, a standing aid gives an alternative to sitting in a wheelchair. Many youngsters with balance or control issues who are unable to stand may benefit from standing or playing using a standing assistant. Table 4 shows that a standing aid has several advantages.

Table 4: The Benefits of a Standing Aid

Bone mineral density:	When they stand and walk, it helps to strengthen the bones in their pelvis, spine and legs.
Posture:.	Standing can help to stretch out tight muscles and maintain good range of motion. It is especially helpful for tight hamstrings, calves and the muscles at the front of the hips
Bladder and bowel:.	When in standing, gravity and the contraction of the stomach muscles help to keep things moving
Respiration:	Standing is excellent for improving children's breathing and helps to reduce the incidence and severity of upper respiratory infections.
Circulation:	Standing up improves circulation and blood pressure due to the change in orientation.
Hip development:	When children start standing it helps to develop the hip joint into a more stable position.
Alternate positioning:	It is important to use a variety of positions to keep skin and tissue healthy and to help children to engage socially.
Wellbeing:	Children who are involved in a standing program have been shown to have improved alert-ness and sleep patterns, decreased fatigue and improved feeling of wellbeing.

(Notes: National Institute of Child Health and Human Development. What Are Some Types of Assistive Devices and How Are They Used? https://www.nichd.nih.gov/health/topics/rehabtech/conditioninfo/device)

5 Conclusions

Cerebral palsy is the most prevalent cause of motor impairment in children, and it is linked to lifelong disability according to a previous study. Although the underlying brain damage is

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irreversible, many health services are dedicated to providing rehabilitative and adaptive support to help people with disabilities in attaining their full potential. A simple type of AT with certain modifications may be beneficial in assisting the adaptive abilities of children with CP at various degrees of functioning. More studies are needed to ensure that AT devices are used effectively to help children with their daily activities.

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