



The Healer Journal of Physiotherapy and Rehabilitation Sciences



Journal homepage: www.thehealerjournal.com

Effects of Spider Cage Therapy on Motor Control in Children with Cerebral Palsy

Nisar Fatima¹, Amina Mehak Hasnat², Anbreena Rasool^{2*}, Ali Raza¹, Bilal Umar¹, Fizza Hussain²

¹Faculty of Rehabilitation and Allied Health Science, Riphah International University, Faisalabad, Pakistan

^{2*}Department of Rehabilitation Sciences, The University of Faisalabad, Faisalabad, Pakistan

KEYWORDS

Cerebral palsy
Motor control
Spider cage therapy

DECLARATIONS

Conflict of Interest: None
Funding Source: None

CORRESPONDING AUTHOR

Anbreena Rasool
Department of Rehabilitation Sciences, The University of Faisalabad, Faisalabad, Pakistan
anbreenarasool.dpt@tuf.edu.pk

ABSTRACT

Background: Cerebral palsy is a non-progressive neurological disorder characterised by abnormalities in posture and movement due to brain injury occurring during fetal life or postnatally. Its causes may include oxygen deficiency, jaundice, prematurity, or traumatic brain infections. Children with cerebral palsy often present with motor and sensory impairments, as well as visual, auditory, and cognitive deficits. Spider cage therapy, also known as the universal cage unit, is a three-dimensional metal structure used in rehabilitation protocols for neurological conditions such as cerebral palsy. This therapy involves elastic cords attached to a belt at the waist of the child, supporting functional motor training including kneeling, half-kneeling, single-leg standing, and jumping. **Objective:** To evaluate the effects of spider cage therapy on motor control in children with hemiplegic cerebral palsy. **Methodology:** This randomised controlled trial included children aged 4 to 10 years diagnosed with hemiplegic cerebral palsy, assessed using the Gross Motor Function Classification System and the Modified Ashworth scale. Children with severe disabilities, seizure instability, mental retardation, multiple contractures, bone diseases, deformities, or a history of meningitis were excluded. Participants were recruited from Mubarak Medical Complex, Khawaja Arshad Hospital, and DHQ Sargodha. After obtaining informed consent, participants were randomly allocated into two groups using the lottery method. The experimental group received spider cage therapy along with general warm-up exercises, 5 days a week for 4 months, targeting motor control activities such as kneeling, half-kneeling, single-leg standing, and jumping. The control group received conventional physiotherapy, consisting of warm-up and stretching exercises, five days a week for four months. Assessments were conducted at baseline, 3 weeks, 6 weeks, and 9 weeks post-intervention. **Results:** The experimental group demonstrated greater improvement in motor control activities compared to the control group across all assessment points. This therapy contributed to enhanced postural stability and functional motor tasks. **Conclusion:** Spider cage therapy is an effective rehabilitation intervention for improving motor control in children with hemiplegic cerebral palsy. It provides postural support and resistance training that enhances motor function, particularly in weight-bearing and dynamic balance activities.

How to cite the article: Fatima N, Hasnat AM, Rasool A, Raza A, Umar B, Hussain F. Effects of Spider Cage Therapy on Motor Control in Children with Cerebral Palsy. The Healer Journal of Physiotherapy and Rehabilitation Sciences. 2025;5(2):184-190.



Copyright©2025. The Healer Journal of Physiotherapy and Rehabilitation Sciences.
This work is licensed under [Creative Commons Attributions 4.0 International license](https://creativecommons.org/licenses/by/4.0/).

INTRODUCTION

Cerebral palsy (CP) is a continual but it is non-progressive condition of movement and posture, related to functional limitations and cognitive, sensory issues, problems in communication, brain disorder, and muscle-related problems.¹ Hemiplegic children hold well-marked extremity engagement, inordinate thumb flexion, adduction and constricted wrist joint extension actively by babyhood. Post-lesion anomaly moves towards an advanced abnormal condition, the development of motor grouping. Perturbation visual, somatosensory and developmental neglect. Moving towards difficulties in using the hand. Progressive bony changes and soft tissue may happen, move towards contractures, which cause further function limitation in a vicious cycle.²

Hemiplegia is a word form of spastic cp in which one leg and one arm may be the left or right side of the body. Hemiplegic CP affects the upper extremity to a greater degree than the lower extremity. They more frequently acquire repeated unprovoked seizures. Hemiplegic cerebral palsy children whose clinical structure affects the lower and upper extremities to an equal extent ('proportional') seem to fall between the leg-dominant and arm-dominant groupings.³ Hemiplegic gait pattern is based on sagittal joint kinematics and presents four types of patients, with an advanced distal-proximal engagement of the paretic lower extremity.⁴ Type I indicates the existence of a fallen human foot. Incoming swinging stage, type II by continuity of equinism in the gait cycle, with a accomplishable knee hyperextension in the stance phase, type III also displays a decreased flexed knee in the swing stage, type IV, add-on, displays an ablated movement of the hip. Still, the most ordinary forms observed in hemiplegic CP children are the moderate forms, types I and II. Comparability, the children with hemiplegic cerebral palsy have hand closure posture and a flexed and adducted thumb in the first few months. On the other hand, pronation of the forearm and thumb abnormality is mainly seen in a hemiplegic CP child.^{5,6}

Another study also reported deformities of the hand that are structural at age 2 years. Spider cage is a 3-dimensional unit. The spider cage consists of metal having cords that are detached to different points on a special belt. This special belt is set in the region of the waist of cerebral palsy child, which assists the child with cerebral

palsy.⁷ The spider cage is a unique cage in which cerebral palsy child move freely independently while their movements are controlled with greater imprecision and ease. In this suspension, spider cage body parts are strengthened. It helps improve the stability of cerebral palsy, coordination and balance. Spider cage also improves the alignment of the body and gives knowledge of their body parts' proprioception. Cords are elastic and can help strengthen weak muscles.⁵

It is in use as a portion of intense pediatric physical therapy, along with other interventions of physical therapy. Spider cage was formed and organised in the 1940s and has a pulley system along the cage that is made up of metal, along with cords that is elastic cords and belts.⁸ The Gross Motor Function Measure scale (GMFM) was organised by Russell et al. in 1993 which was utilised to measure motor developmental levels, as well as also it was use in gross motor function changes successful standard surroundings in children with cerebral palsy. GMFM-66 was open to a subset of the GMFM-88 component known (direct Rasch reasoning) to measure functions of overall motor in people with cerebral palsy, varying from 0 - 100 (lower to higher motor function).⁹

For children with cerebral palsy with hemiplegia, the function of one hand is fine while dysfunction in other hand. Alteration of the upper extremity produces complications in approximately every form of human motion: school, personal-care or activity, commitment to engage in recreation/spare time actions. The distinctiveness of the hemiplegic hand can be described as weak and slow, accomplished by awkward actions, unfinished finger fractional, jerkiness, and usually impaired deep touch feeling.¹⁰ Motor impairments of unreliable severity caused by a lesion in the brain in early development are the main feature in the medical image of CP.¹¹

In the everyday activities of people with CP, a lot of functional restrictions of dissimilar harshness limit or even prevent their energetic contribution, and involvement in public. Five levels of ordinal scales, in which a high level represents a greater functional restriction. Both BFMF and MACS levels are intended to match GMFCS levels. Taken simultaneously, they give helpful information that completes the cerebral palsy child's clinical representation.³ The GMFCS and GMFCS-E&R

decide the plane most excellent represents the child's present total motor ability and limitations, depending on the estimation of self-initiated actions, significant daily, with particular importance on sitting, mobility and transfer.⁵ The hemiplegic CP child, dystonia and/or spasticity, coordination shortage, impaired dexterousness and weakness are problems at the stage of body function. Arm movement restrictions are a sign of the difficulties experienced during releasing, reaching, manipulation and grasping objects with the hemiplegic affected arm and affected hand.²

Spider cage therapy is also named the universal exercise unit and monkey unit. This cage unit assists the children to weight shift more freely and motor-assisted motility, like as jumping, sitting to standing and low-set. In the forties, motivated plus formed a spider cage whole to make stronger lame musculus. Presently, it is exploited with a pulley scheme and a suspension scheme. Spider cage has its personal beneficial belongings on cp children because it directly arouses the vestibule structure and structure of proprioception. Spider cage unit is a three-dimensional cage unit prepared by metal, similar to iron, adding wires, weights, rubber bands, pulleys, and belts.¹² To evaluate the effects of Spider Cage Therapy on motor control in children with hemiplegic cerebral palsy.

METHODOLOGY

This randomized clinical trial was conducted to evaluate the effectiveness of spider cage therapy in children with spastic hemiplegic cerebral palsy. A non-probability purposive sampling technique was employed to recruit participants, who were then randomly assigned into two groups using the lottery method. The study included children aged 4 to 10 years with a diagnosis of hemiplegic cerebral palsy, a Modified Ashworth Scale (MAS) grade of two, and GMFCS level II. Eligible participants were those who were cooperative, motivated, and able to follow verbal commands. Children with severe disabilities, seizure instability, mental retardation, multiple contractures, bone diseases, deformities, or a history of meningitis were excluded.

The study was conducted over four months following ethical approval, and data were collected from Mubarak Medical Complex, Khawaja Arshad Hospital, and DHQ Hospital in Sargodha. Written and verbal informed consent

was obtained from the participants' guardians before inclusion. Motor abilities were assessed using the GMFCS-88, while spasticity was measured using the MAS. Assessments were conducted at four time points: baseline (before intervention), after 3 weeks, after 6 weeks, and at the end of the 9-week intervention. Participants were randomly assigned to two groups. Group A (experimental group) received spider cage therapy, while Group B (control group) received conventional physical therapy. Both groups received treatment five days per week for nine weeks, totalling 45 sessions. Each session lasted approximately one hour.

The experimental group received therapy using the spider cage system, which is a three-dimensional metal frame with elastic cords attached to a belt worn around the participant's waist. This setup provided support during functional activities such as kneeling, half-kneeling, one-leg standing, and jumping. Each session included general body warm-up exercises and passive range of motion (ROM) exercises (neck rotation, elbow flexion and extension, knee extension, and ankle rotation), each performed for 20 minutes with 10 repetitions.

The control group received conventional therapy, including similar passive ROM exercises and general warm-ups.¹³ Additionally, they performed stretching exercises targeting the hamstrings, quadriceps, knees, wrists, and shoulders. Each stretch was held for 5 seconds bilaterally, followed by a sustained end-range stretch held for 40 seconds with therapist support.¹³ Each stretch was repeated five times. Data collected at each assessment point were analyzed to determine the impact of spider cage therapy on motor control and spasticity in children with spastic hemiplegic cerebral palsy.

RESULTS

The study aimed to find out the effects of spider cage therapy on the motor control in children with hemiplegic cerebral palsy. For this purpose, 28 patients were taken from Mubarak Medical Complex, Khawja Arshad Hospital and DHQ Hospital, Sargodha. Two groups were formed, each consisting of 14 patients. Group A received the spider cage therapy while Group B received conventional physical therapy only. Data from 28 children with hemiplegic cerebral palsy (Group 1: spider cage therapy, n=14; Group 2: conventional

physical therapy, n=14) were analysed. The mean age was 6.96 ± 1.79 years, with no significant age difference between groups ($p=0.759$).

Modified Ashworth Scale¹⁴ (MAS) scores indicated a significant reduction in spasticity in Group 1 compared to Group 2 across follow-up points. At baseline, MAS scores were comparable (Group 1: 3.35 ± 1.00 ; Group 2: 3.71 ± 0.91 ; $p=0.376$). At 9 weeks, Group 1 showed greater improvement (1.07 ± 0.99) than Group 2 (2.21 ± 0.89 ; $p=0.006$). The GMFM subscales C (crawling & kneeling), D (standing), and E (Walking, Running, & Jumping) improved significantly in both groups over time, with Group 1 consistently outperforming Group 2. At 6 weeks, GMFM-C was higher in Group 1 (18.42 ± 0.75) compared to Group 2 (13.71 ± 1.32 ; $p<0.001$). GMFM-D at 6 weeks was significantly higher in Group 1 (19.00 ± 1.75) compared to Group 2 (16.07 ± 1.59 ; $p<0.001$). GMFM-E at 6 weeks was also higher in Group 1 (7.14 ± 0.66) than in Group 2 (5.42 ± 0.85 ; $p<0.001$).

The effects of spider cage therapy on spasticity levels in children with hemiplegic cerebral palsy, as measured by the MAS. The Y-axis represents the mean MAS scores, while the X-axis indicates the time points: baseline (pre-treatment), mid-treatment (week 4), and post-treatment (Week 8). A decreasing trend in MAS scores is observed across these time points, indicating a reduction in spasticity levels following the therapy. This suggests that spider cage therapy is effective in improving motor control by reducing muscle tone in hemiplegic cerebral palsy children.

DISCUSSION

It was shown in the present study that Spider Cage Therapy resulted in much better improvements in spasticity and gross motor function in children with hemiplegic cerebral palsy as compared to routine physical therapy.

These outcomes agree with what previous research has shown about Spider Cage Therapy helping motor function in children with cerebral palsy.^{15, 16} The therapy uses a flexible network that allows specific muscles to be activated and gives dynamic support for the safe practice of daily activities.¹⁷ The environment and the way the nurses treated the patients might have helped reduce the Ashworth scores at 3, 6, and 9 weeks for the intervention group. Better coordination and tone in the nervous system may be the reason for a drop in spasticity that is seen early.¹⁸ More improvement in crawling and kneeling, standing, and walking, running, and jumping was found among those in the Spider Cage group than in those who had regular therapy.

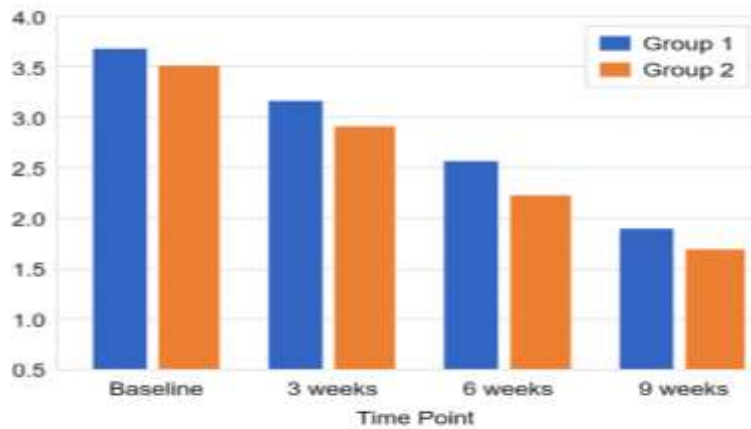
It has been seen in several studies that the GMFM subscales also improve when spider cage therapy and its adjuncts are used.¹⁹ In addition, based on Saravanan et al.¹, Spider cage training helped children with cerebral palsy improve their balance and gross motor skills. Unlike the Bobath concept and constraint-induced movement therapy, spider cage therapy addresses other aspects of movement control. Spider Cage helps improve posture, choose the right movements, and sense your position, offering many ways to train your legs and stand safely. It has much in common with trunk-targeted interventions that also improve results on the GMFM.²⁰ When spider cage therapy is used with virtual reality, it appears to lead to more improvements in motor ability and balance, which indicates that using different rehabilitation methods at once might work well.²¹

While scientists have not confirmed how well electrical stimulation works with spider cage therapy for children with cerebral palsy, it may still be tried as an added treatment.²² Latest studies continue to explore the role of adjunct therapies. Recent work by Park et al. indicated

Table 1: MAS and GMFM subscales over time

Outcome	Time Point	Group 1 (Spider Cage)	Group 2 (Conventional)	p-value
MAS	Baseline	3.35 (1.00)	3.71 (0.91)	0.376
	9 weeks	1.07 (0.99)	2.21 (0.89)	0.006
GMFM-C	6 weeks	18.42 (0.75)	13.71 (1.32)	<0.001
GMFM-D	6 weeks	19.00 (1.75)	16.07 (1.59)	<0.001
GMFM-E	6 weeks	7.14 (0.66)	5.42 (0.85)	<0.001

Figure 1: Within-group difference at different follow-ups



that combining spider cage therapy with task-oriented training enhances selective motor control and trunk stability in spastic CP children. Similarly, Aydoğan et al. highlighted that intensive cage-based rehabilitation programs led to better gait symmetry and reduced muscle co-contractions in children with hemiplegic CP.²⁰ Moreover, electromyographic analysis has demonstrated increased activation of weak muscle groups during cage-assisted training sessions.²¹

Other interventions such as aquatic therapy, hippotherapy, and neurodevelopmental techniques may complement the benefits of spider cage therapy and have shown promising synergistic effects when combined with cage-based regimens.^{22,23} Further exploration of long-term follow-up and carry-over effects into daily life activities is warranted. Emerging evidence also suggests the potential value of electrical stimulation or biofeedback devices when paired with spider cage therapy, especially in children with mixed spastic-dystonic CP.^{24,25} Overall, the present study adds to the growing body of literature supporting spider cage therapy as an effective treatment modality. It fosters neuromuscular coordination, improves balance, and promotes functional independence in children with cerebral palsy, especially those with hemiplegic presentations.

CONCLUSION

The result of this study concluded that spider cage therapy can improve the motor control in hemiplegic cerebral palsy children. The examination shows significant results of the spider cage unit on the motor control of children. Hemiplegic cerebral palsy children are aged between 4 years to 10 years.

DECLARATIONS

Consent to participate: Written consent had been obtained from patients. All methods were performed following the relevant guidelines and regulations.

Availability of data and materials: Data will be available on request. The corresponding author will submit all dataset files.

Competing interests: None

Funding: No funding source is involved.

Authors' contributions: All authors read and approved the final manuscript.

CONSORT Guidelines: All methods were performed following the relevant guidelines and regulations.

REFERENCES

- Günel MK. Fizyoterapist bakış açısıyla beyin felçli çocukların rehabilitasyonu. *Acta Orthop Traumatol Turc.* 2009; 43(2): 173-80.
- Kwon TG, Yi S-H, Kim TW, Chang HJ, Kwon J-Y. Relationship between gross motor function and daily functional skill in children with cerebral palsy. *Annals of Rehabilitation Medicine.* 2013; 37(1): 41-9.
- Barcevičienė I. Telemedicinos panaudojimo teikiant reabilitacijos paslaugas cerebrinį paralyžį turintiems vaikams galimybės: Lithuanian University of Health Sciences (Lithuania); 2021.
- Mannan I, Javed A, Afzal F, Ahmad B, Shah SNA, Rana AA. Effects of Functional Strength Training Using Universal Exercise Unit on Spasticity of Lower Extremities Among Children with Cerebral Palsy; A Quasi-Experimental Study: Functional Strength Training in Cerebral Palsy. *The Healer Journal of Physiotherapy and Rehabilitation Sciences.* 2023; 3(8): 756-61.
- Basu AP, Pearse J, Kelly S, Wisher V, Kisler

- J. Early intervention to improve hand function in hemiplegic cerebral palsy. *Frontiers in Neurology*. 2015; 5: 281.
6. Bakhat W, Ahmed U, Asghar M, Hanif K, Bibi S, Ghani S. Effects of Expanded Constraint-Induced Movement Therapy on Hand Function in Children with Cerebral Palsy: A Randomized Controlled Trial: Constraint-Induced Movement Therapy in Cerebral Palsy. *The Healer Journal of Physiotherapy and Rehabilitation Sciences*. 2022; 2(2): 119-28.
7. Ekvall SW, Ekvall S, Ekvall VK. Pediatric and adult nutrition in chronic diseases, developmental disabilities, and hereditary metabolic disorders: prevention, assessment, and treatment: Oxford University Press; 2017.
8. Guzzetta A, Fazzi B, Mercuri E, Bertuccelli B, Canapicchi R, van Hof-van Duin J, et al. Visual function in children with hemiplegia in the first years of life. *Developmental Medicine and Child Neurology*. 2001; 43(5): 321-9.
9. Gordon AM, Charles J, Steenbergen B. Fingertip force planning during grasp is disrupted by impaired sensorimotor integration in children with hemiplegic cerebral palsy. *Pediatric Research*. 2006; 60(5): 587-91.
10. Gorter JW, Rosenbaum PL, Hanna SE, Palisano RJ, Bartlett DJ, Russell DJ, et al. Limb distribution, motor impairment, and functional classification of cerebral palsy. *Developmental Medicine and Child Neurology*. 2004; 46(7): 461-7.
11. Afzal F, Gulraiz Q, Manzoor S. Role of Spider Cage in Motor Control in Cerebral Palsy. *Int J Phys Med Rehabil*. 2017; 5(2).
12. Masood F, Khan MSG, Afzal F, Rashid A, Mubarak S. Effects of spider cage therapy in combination with conventional speech therapy on speech and language function in children with cerebral palsy of age between 05 and 15 years. *Journal of Pharmaceutical Research International*. 2021; 33: 145-9.
13. Latif A, Shah SM, Shabbir S, Nawab A. Effects of Trunk Strengthening Exercises on Static Sitting Balance in Children with Quadriplegic Cerebral Palsy: Trunk Strengthening Exercises in Quadriplegic Cerebral Palsy. *The Healer Journal of Physiotherapy and Rehabilitation Sciences*. 2023; 3(7): 682-8.
14. Syed H, Shamim Q, Niaz T, Dastgir H, Ilyas A, Rasul A. Reliability of Modified Ashworth Scale as compared to Modified Tardieu Scale on Assessment of Lower Limb Spasticity in Children with Diplegic Cerebral Palsy: Reliability of Ashworth Scale in Cerebral Palsy. *The Healer Journal of Physiotherapy and Rehabilitation Sciences*. 2023; 3(7): 696-702.
15. Saravanan S, Alagesan J. Effectiveness of Spider Cage Therapy for Balance Control in Spastic Diplegic Cerebral Children: A Pilot Study. *Indian Journal of Physiotherapy & Occupational Therapy*. 2024; 18.
16. Gamit SB, Sutaria JM. Effect of Spider Therapy on Motor Functions and Balance in Cerebral Palsy Evidence Based Study. *International Journal of Science and Healthcare Research* DOI: <https://doi.org/10.52403/ijshr.2021;20210722>.
17. Sarhan EE, Khatwa AMA, Ibrahim MB, Salamah A, Abdullatif HM, Ramadan SMM, et al. Effect of virtual reality in spider cage on gross motor performance and balance in children with spastic diplegia. *Revista Iberoamericana De Psicología Del Ejercicio Y El Deporte*. 2024; 19(4): 407-11.
18. O'Sullivan SB, Schmitz TJ. Arthritis. *Physical Rehabilitation*, 5th edition. Philadelphia: FA Davis Company. 2007: 1057-90.
19. Gordon AM, Charles J, Wolf SL. Methods of constraint-induced movement therapy for children with hemiplegic cerebral palsy: development of a child-friendly intervention for improving upper-extremity function. *Archives of Physical Medicine and Rehabilitation*. 2005; 86(4): 837-44.
20. Glowinski S, Blazejewski A. Spider as a rehabilitation tool for patients with neurological disabilities: The preliminary research. *Journal of Personalized Medicine*. 2020; 10(2): 33.
21. Kaushik K, Kumar K. Effect of Cage Therapy using Advanced Spider Suit Compared to Traditional Physical Therapy on Gross Motor Function in Children with Cerebral Palsy—An Indian Experience. *International Journal of Neurorehabilitation*. 2016; 3(1000193): 2376-0281.1000193.
22. Ahmad S, Mukhtar MF, Habib H, Arshad F, Azfar H, Ghafoor IA, et al. Effects of spider cage therapy on motor control of hemiplegic cerebral palsy children.
19. Park EY, Kim WH. Effects of task-oriented training with Spider Cage on gross motor function and trunk control in children with spastic cerebral palsy. *Developmental Neurorehabilitation*. 2021;24(3):199-205.
20. Aydoğan S, Bek N, Demirel A. Effects of intensive cage-based rehabilitation on functional motor outcomes in children with hemiplegic cerebral palsy. *Turkish Journal of Physical Medicine and Rehabilitation*. 2022;68(1):78-85.

21. Huang HH, Chen CL, Hsu HC, et al. Muscle activation patterns in children with cerebral palsy during spider cage-assisted gait. *Clinical Biomechanics*. 2020;73:131–7.
22. López M, Badillo C, González V, et al. Aquatic-based Spider Cage therapy in pediatric rehabilitation: a case-controlled pilot study. *Journal of Pediatric Rehabilitation Medicine*. 2023;16(1):55–62.
23. Rezvani MH, Mozaffari SF, Bagheri H. Effect of combined hippotherapy and Spider Cage therapy on balance and postural control in CP children. *Iranian Journal of Child Neurology*. 2022;16(2):47–54.
24. Chang JH, Hwang JH, Lee EJ. Effects of electrical stimulation combined with Spider Cage therapy on gait and motor function in children with mixed CP. *Neuropediatrics*. 2020;51(4):273–8.
25. Demirci E, Koseoglu F, Yıldız N. Effectiveness of biofeedback-assisted Spider Cage therapy in children with spastic hemiplegia: a randomized controlled trial. *European Journal of Paediatric Neurology*. 2023;37:91–8.