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EFFECTIVENESS OF PILATES ON THE POSTURE AND BALANCE OF AN ATHETOID CEREBRAL PALSY CHILD.A CASE STUDY

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INTRODUCTION

Cerebral Palsy is a non-progressive neurodevelopmental disorders resulting from injury or dysfunction of the immature brain, which will be present throughout individual's life. This condition impacts posture, voluntary movements, and the ability to execute coordinated and purposeful actions. A wide array of disorders associated with CP can affect communication skills, motor functions, cognitive capabilities, perception, sensory experiences, and psychosocial behavior.[1]. It ranks as the most common severe disability among children, following severe intellectual impairment. In school-aged children, its prevalence is twice that of Down syndrome, and it constitutes 60% of all severe motor disabilities.[4].Cerebral palsy currently lacks a cure and has limited disease-modifying interventions; therefore, the primary focus of treatment is on managing symptoms[2]

There are many types of cerebral palsy among those Athetoid cerebral palsy (CP) is a prevalent movement disorder resulting from neonatal hypoxia, which leads to damage in the basal ganglia. This condition is marked by involuntary movements and irregularities in posture.[3]Athetoid cerebral palsy represents 5 to 10% of all cases of cerebral palsy and is distinguished by dysfunction of the basal ganglia. This condition results in the impairment of postural reflexes, the presence of arrhythmic involuntary movements, and dysarthria, while typically preserving sensation, ocular movements, and often cognitive abilities.[5]The main characteristic of athetosis is an inconsistent and variable muscle tone. Bobath (1960) observed that children with athetoid movements display a wide range of motion in their limbs and posture, along with a notable absence of cocontraction, which refers to the challenge of achieving simultaneous contraction of both agonist and antagonist muscles. As a result of these challenges, individuals with athetoid movements

demonstrate inadequate postural stability, exhibiting movements that are both exaggerated and erratic, as well as joint hypermobility that may lead to subluxation.

The impairment of selective motor control and the presence of muscle weakness are significant factors that disrupt normal gait patterns in individuals with cerebral palsy (CP). Recent research indicates that muscle weakness has a greater impact on motor function in children with CP than spasticity does.

Balance disorders present a significant challenge for children diagnosed with cerebral palsy, complicating their ability to attain and sustain equilibrium. These children often exhibit diminished neuromotor perceptual capabilities, insufficient stability while standing in various sensory environments, delayed anticipatory responses, and imprecise preparatory activation. While traditional treatment approaches for this demographic have been explored, the efficacy of exercises like Pilates has not yet been investigated in this specific group[6,7].

Postural deformities also considerably affect both the quality of life of children with cerebral palsy (CP) and their mortality rates. The presence of severe scoliosis and an abnormal chest structure results in lung compression. Consequently, respiratory issues are common among individuals with CP and represent a major factor contributing to mortality[8] . Pilates is an alternative physical activity that can improve postural alteration.

Pilates is a form of exercise that incorporates stretching, strengthening, and coordination techniques. It is founded on six essential principles: breathing, control, centering, flexibility, concentration, and precision. Studies have investigated the effects of Pilates on various populations, including healthy adults, the elderly, and individuals with musculoskeletal conditions. This practice enhances trunk flexibility, improves the strength and endurance of abdominal and trunk muscles, and promotes the engagement of deep core muscles.[9]

It can be inferred that Pilates may improve the body's capacity for relaxation, facilitate muscle contraction, and enhance strength, flexibility, and balance. Consequently, it is reasonable to assert that children with cerebral palsy who are capable of performing functional tasks like standing and walking, yet require further development in areas essential for controlled movements—such as joint flexibility, muscle strength, postural stability, and mobility—could gain advantages from Pilates training.[9].In this research the effectiveness of pilates intervention on an athetoid cerebral palsy is studied as an experimental study

AIMS & OBJECTIVES

AIM:

To find out the effectiveness of pilates on the balance and posture of an athetoid cerebral palsy child . A case study

OBJECTIVES:

1. To assess balance using Pediatric Balance Scale
2. To assess posture using Posture and Postural Ability Scale (PPAS)
3. GMFM-88 to assess the gross motor functional ability

HYPOTHESES:

Null Hypothesis (H0): There was no significant difference in balance and posture of an athetoid cp child using pilates

Alternative Hypothesis (H1): There was a significant difference in balance and posture of an athetoid cp child using pilates

REVIEW OF LITERATURE

1. **Hatice Adıgüzel, Bulent Elbasan** did a study on **Effects of Modified Pilates Training on Hemodynamic Responses in Children with Cerebral Palsy: A Single-Blinded Randomised Controlled Study (2024)** which highlights the role of core stability and respiratory function in managing cerebral palsy (CP). While neurodevelopmental therapy (NDT) addresses motor impairments, Modified Pilates Exercises (MPE) focus on core strength and trunk control, showing promise in enhancing gross motor function, hemodynamic responses, and transversus abdominis activity.

2. **Ragab K Elnaggar , Rodrigo Ramirez-Campillo , et al** did a study on **Optimization of Postural Control, Balance, and Mobility in Children with Cerebral Palsy: A Randomized Comparative Analysis of Independent and Integrated Effects of Pilates and Plyometrics (2024)** which shows that Comprehensive therapeutic approaches are vital for children with cerebral palsy (CP). Studies show Pilates-based core strengthening (PsCS) and plyometric-based muscle loading (PlyoML) improve postural control and mobility. Combining PsCS and PlyoML yields significantly greater benefits for balance and functional mobility compared to either modality alone in children with unilateral CP.

3. **Clodagh Coman , Dara Meldrum, et al** did a study on **The effect of a Pilates-based core exercise group on balance and gait in ambulant children with Cerebral Palsy: A Randomised Control Trial (2023)** which highlights that ambulant children with cerebral palsy face challenges in trunk control, affecting gait and balance. Pilates-based exercises show limited impact on trunk and lower limb kinematics or balance, emphasizing the need for supervised and flexible interventions to address adherence and maximize therapeutic outcomes.

4. **Hanaa Mohsen Abd-Elfattah , Dina Othman Shokri Morsi Galal , et al** did a study on **Effect of Pilates Exercises on Standing, Walking, and Balance in Children With Diplegic Cerebral Palsy (2022)** which highlight the benefits of Pilates exercises in enhancing standing, walking, and balance in children with diplegic cerebral palsy. When combined with conventional therapy, Pilates significantly improves gross motor function and balance, outperforming conventional therapy alone in effectiveness.

5. **Hanaa Mohsen Abd-Elfattah , Dina Othman Shokri Morsi Galal , et al** did a study on **The Effectiveness Of Pilates Exercises On Sitting And Standing Balance In Children With Cerebral Palsy (2022)** which reveal that Pilates exercises significantly improve sitting balance in children with cerebral palsy but show no statistically significant impact on standing balance. This research emphasizes Pilates' potential as a therapeutic method for enhancing sitting stability in children with cerebral palsy.

6. **F Widiandoko, Lobes Herdiman, et al** did a study on **Evaluation in design of walker trainer for spatial ataxic athetoid cerebral palsy children using kinect sensor as observation method for assessing body posture on walking (2020)** determine that using the REBA method and 3DSSPP software show that a new walker trainer improves posture and reduces musculoskeletal risk in children with cerebral palsy. Compared to the old walker, the new trainer lowers REBA scores and back compression forces, enhancing safety and usability during walking.

7. **Farjad Afzal, Sidra Manzoor** did a study on **Effects of physical therapy treatment in children with Athetoid Cerebral PALSY (2019)** which indicates that treadmill training, stationary cycling, functional exercises, and walking training significantly improve gross motor function, trunk stability, standing time, and walking distance in children with athetoid cerebral palsy, emphasizing the effectiveness of combined physical therapy interventions for enhancing mobility and functional independence.

8.**Ji-won Shin, Gui-bin Song , et al** did a study on **Effects of Trunk Strengthening Exercises on Static Sitting Balance in Children with Quadriplegic Cerebral Palsy (2017)** which demonstrates that trunk and neck stabilization exercises significantly enhance static sitting balance, selective movement control, and dynamic reaching in children with cerebral palsy. Active participation in such exercises over eight weeks improves both static and dynamic trunk balance abilities, as shown by Trunk Control Measurement Scale scores.

9. **Mubashra Khalid, Arjad afzal, et al** did a study on **Outcomes of universal exercise unit (ueu) in combination with conventional physical therapy on trunk control improvement in spastic and athetoid type cerebral palsy children (2016)** which emphasize the significance of trunk control in improving functional outcomes for children with cerebral palsy (CP). Interventions like the Universal Exercise Unit, combined with conventional therapies, have demonstrated effectiveness in enhancing trunk stability, motor control, and overall functional independence in CP management.

10.**Elisabet Rodby-Bousquet , Måns Persson-Bunke , et al** did a study on **Psychometric evaluation of the Posture and Postural Ability Scale for children with cerebral palsy (2016)** shows that The Posture and Postural Ability Scale demonstrates strong psychometric properties, including construct validity, internal consistency, and inter-rater reliability. Its application for children with cerebral palsy aligns with findings from adult evaluations, supporting its utility in identifying postural deficits, asymmetries, and targeted support needs across diverse functional levels.

11. **Anna Lucia Barker, Marie-Louise Bird, et al** did a study on **Effect of Pilates Exercise for Improving Balance in Older Adults: A Systematic Review With Meta-Analysis (2014)** which indicates Pilates improves balance and may reduce falls in older adults, though evidence on falls is limited. Studies often lack methodological rigor and adherence to best-practice recommendations, suggesting potential for greater effects if moderate-to-high balance challenges and optimal exercise protocols were consistently implemented.

12. **Adriana Neves Dos Santos, Simoni Sayuri Serikawa, et al** did a study on **Pilates improves lower limbs strength and postural control during quite standing in a child with hemiparetic cerebral palsy: A case report study (2014)** highlight the benefits of Pilates in enhancing muscle strength, postural stability, and balance in individuals with motor impairments, including children with cerebral palsy. Pilates promotes neuromuscular control and functional improvements, making it a valuable rehabilitation tool for mild motor deficits and high functional levels.

13. **Arzu Guclu-Gunduz , Seyit Citaker , et al** did a study on **The effects of pilates on balance, mobility and strength in patients with multiple sclerosis (2014)** shows that Pilates benefits in improving dynamic balance, muscle strength, and flexibility in healthy individuals. However, evidence regarding its effects on patients with Multiple Sclerosis remains limited, necessitating further exploration of its potential role in enhancing balance, mobility, and strength in this population.

14. **Lourembam Surbala Devi, Ratan Khuman, et al** did a study on **Pilates versus Conventional Balance Training on Functional Balance and Quality of Life in Elderly Individuals: A Randomized Controlled Study (2014)** shows that both Pilates intervention (PI) and conventional balance training (CBT) have been shown to improve functional balance and quality of life (QOL) in elderly individuals. However, Pilates was found to be more effective than CBT in enhancing functional balance and QOL, highlighting its potential for fall prevention and improved mobility in older adults.

15.**Marietta L van der Linden, Catherine Bulley, et al** did a study on **Pilates for people with multiple sclerosis who use a wheelchair: feasibility, efficacy and participant experiences (2013)** shows that pilates helps to improve sitting stability, posture, and reduce pain in individuals with Multiple Sclerosis (MS) who use wheelchairs. Participants reported physical, functional, psychological, and social benefits, highlighting increased confidence in daily activities. These findings suggest Pilates is well-tolerated and effective, warranting further research.

16. **Mahmood Bahramizadeh , Mohammad Ebrahim Mousavi, et al** did a study on **The effect of floor reaction ankle foot orthosis on postural control in children with spastic cerebral palsy (2012)** which highlights postural control challenges in children with cerebral palsy (CP) and explores orthotic interventions like floor reaction ankle-foot orthoses (FRAFO). While FRAFO improves knee alignment, its short-term impact on postural control parameters such as CoP displacement and velocity remains inconclusive, warranting further investigation.

17. **Sureeporn Phrompaet , Aatit Paungmali ,et al** did a study on **Effects of Pilates Training on Lumbo-Pelvic Stability and Flexibility (2011)** which demonstrate Pilates effectiveness in enhancing flexibility and lumbo-pelvic stability. Regular Pilates training improves trunk and pelvic control while reducing susceptibility to musculoskeletal injuries. However, evidence comparing its benefits with non-exercise controls highlights the need for further research into its preventive and rehabilitative potential.

18. **Gonul Babayigit Irez , Recep Ali Ozdemir, et al** did a study on **Integrating Pilates exercise into an exercise program for 65+ year-old women to reduce falls (2011)** which shows that Pilates exercises have been shown to improve dynamic balance, flexibility, muscle strength, and reaction time in older adults. These improvements may reduce fall risk among elderly women, highlighting Pilates as an effective intervention for enhancing physical function and preventing falls in this population.

19. **Marie-Louise Bird , Keith D Hill, et al** did a study on **A Randomized Controlled Study Investigating Static and Dynamic Balance in Older Adults After Training With Pilates (2011)** shows that Pilates intervention improved static and dynamic balance in older adults, with notable enhancements in mediolateral sway and dynamic tests. While no between-group differences were found, likely due to the crossover design or small sample size, Pilates demonstrated potential for neuromuscular adaptations and sustained balance benefits post-intervention.

20. **June A Kloubec** did a study on **Pilates for improvement of muscle endurance, flexibility, balance, and posture (2010)** which indicates that Pilates exercises effectively enhance abdominal endurance, hamstring flexibility, and upper-body muscular endurance over 12 weeks. While posture and balance showed no significant improvement, the low-intensity, accessible nature of Pilates makes it suitable for promoting muscular endurance and flexibility in middle-aged adults.

21. **Patrick J Culligan , Janet Scherer, et al** did a study on **A randomized clinical trial comparing pelvic floor muscle training to a Pilates exercise program for improving pelvic muscle strength (2010)** which suggest that both Pilates and pelvic floor muscle training (PFMT) can similarly enhance pelvic muscle strength in women with minimal pelvic floor dysfunction. While both interventions improve related questionnaire scores, further research is needed to confirm Pilates' effectiveness in treating pelvic floor dysfunction.

22. **Hua-Fang Liao, Ying-Chi Liu, et al** did a study on **Effectiveness of Loaded Sit-to-Stand Resistance Exercise for Children With Mild Spastic Diplegia: A Randomized Clinical Trial (2007)** which suggest that functional strengthening programs, such as loaded sit-to-stand (STS) exercises, can enhance motor abilities, muscle strength, and walking efficiency in children with cerebral palsy, particularly those with mild spastic diplegia. These exercises show promise in improving basic functional outcomes, though their impact on gait speed may vary.

23. **Hua-Fang Liao , Ying-Chi Liu , et al** did a study on **Loaded and Unloaded Sit-to-Stand Strengthening Exercises Effect to Gross Motor Function Measure in Spastic Diplegia Cerebral Palsy Patients (2007)** which shows that both sit-to-stand and loaded sit-to-stand exercises have been used to improve motor skills in standing, walking, and running in children with spastic diplegia cerebral palsy. While the loaded exercise group showed slightly higher improvements in Gross Motor Function Measure (GMFM) scores, significant differences between the two groups were not observed

24. **Rochenda Rydeard , Andrew Leger, et al** did a study on **Pilates-based therapeutic exercise: effect on subjects with nonspecific chronic low back pain and functional disability: a randomized controlled trial (2006)** has shown that pilates based therapeutic exercise reduce functional disability and pain intensity in individuals with chronic low back pain (LBP). This approach proved more effective than usual care, with improvements sustained for up to 12 months, suggesting its long-term benefits for managing chronic LBP.

25. **Gabriella Hennington , Jean Johnson, et al** did a study on **Effect of bench height on sit-to-stand in children without disabilities and children with cerebral palsy (2004)** shows that Children with cerebral palsy (CP) take longer to complete sit-to-stand (STS) movements than children without disabilities, primarily due to slower extension against gravity. Seat height affects kinematic and force parameters but not total movement time, suggesting invariant motor control parameters govern STS movements regardless of seat height or disability.

METHODOLOGY

STUDY TYPE: Experimental study

STUDY DESIGN AND SETTING: This study was conducted by using pre-test and post test experimental study design, at National Institute for Empowerment of Person with Multiple Disabilities in Chennai. The period of Intervention and the data collection was for 8 weeks

SAMPLE SIZE: 1

DURATION OF STUDY: 8 WEEKS; 5 Times a week; 45minutes to 1hour per session

SELECTION CRITERIA:

Inclusion Criteria:

1. CP Child having athetoid type of CP
2. Child should be cooperative
3. Child should have good cognition
4. Child should have IQ scores above 90 (Normal IQ)
5. GMFCS level 2

Exclusion criteria:

1. Children having any other type of CP Other than athetoid is excluded
2. Lack of cognition abilities
3. Lack of Cooperation
4. Episodes of epilepsy
5. Multiple disability

OUTCOME TOOL

1. PEDIATRIC BALANCE SCALE

The PBS, an adapted version of the BBS, incorporates (1) a rearrangement of test items; (2) a reduction in time standards for maintaining static posture; and (3) clearer instructions. This assessment was conducted by two skilled pediatric physiotherapists. The PBS consists of 14 items and serves as a criterion-referenced tool to evaluate functional balance in relation to daily activities. The 14 components of the PBS assess various functional tasks that a child must execute to operate safely and independently in home, school, or community settings, including sitting balance, standing balance, transitions from sitting to standing, standing to sitting, transfers, stepping, reaching forward, reaching to the floor, turning, and stepping on and off elevated surfaces. Each component is rated on a 4-point scale. The test can be administered and scored in under 20 minutes, utilizing equipment typically available in educational and clinical environments. Research

indicates that this assessment demonstrates strong test-retest and interrater reliability when applied to school-age children with mild to moderate motor impairments

2. POSTURE AND POSTURAL ASSESSMENT SCALE

The Posture and Postural Ability Scale (PPAS) is a unique clinical assessment instrument specifically developed to evaluate the 'quality' and 'quantity' of posture independently across four fundamental body positions: supine, prone, sitting, and standing. The term 'quality' pertains to the body's shape, which involves the specific alignment of body segments in relation to one another and the supporting surface. Conversely, 'quantity' pertains to postural ability, defined as the capacity to stabilize body segments in relation to each other and the supporting surface. This encompasses the control of the center of gravity in relation to the base of support under both static and dynamic conditions. The levels of postural ability are derived from the foundational work of Noreen Hare, who assessed children and adolescents with significant motor impairments and scoliosis. Her Physical Ability Scale has been validated for inter-rater and intra-rater reliability among children. Additionally, these levels are informed by the Chailey levels of abilities, which have been evaluated for validity in children with cerebral palsy. Pauline Pope subsequently modified these scales, incorporating items that assess the quality of posture for individuals with disabilities, irrespective of age or diagnosis. Since the 1990s, trained therapists in England have utilized all three scales. In 2011, Pope and her colleagues in Iceland and Sweden enhanced and revised the assessment tool, resulting in the PPAS. This tool has demonstrated excellent inter-rater reliability (kappa 0.85–0.99), high internal consistency (alpha 0.96–0.97), and construct validity ($p<0.02$) for adults with cerebral palsy when administered by trained professionals; however, it has not yet been assessed for use with children or by less experienced raters. Currently, it is employed in national follow-up programs for adults with cerebral palsy in Sweden and Iceland.

3. GMFM-88

The Gross Motor Function Measure-88 (GMFM-88) serves as a tool for assessing variations in gross motor abilities among children diagnosed with cerebral palsy (CP).

The GMFM-88 is composed of 88 items categorized into five dimensions: lying and rolling (GMFM-A), sitting (GMFM-B), crawling and kneeling (GMFM-C), standing (GMFM-D), and walking, running, and jumping (GMFM-E). The GMFM-88 is a criterion-referenced tool specifically developed to assess the motor skill development of children with cerebral palsy. It has been designed and validated for cp population based on classical test theory principles. This instrument is extensively utilized as both a clinical and research outcome measure, supported by substantial evidence of its reliability, validity, and responsiveness.

The GMFM-88 is sensitive to variations in motor function and can be utilized to assess changes in essential gross motor skills over time in children with cerebral palsy, as well as to evaluate the effectiveness of physiotherapeutic interventions for these children.

PROCEDURE:

A single athetoid cerebral palsy child was selected from NIEPMD school based on the inclusion criteria . The consent form was signed by the parents before the intervention started. The pre test value was taken based on the **gmfm-88** , **Pediatric Balance Scale** and **The Posture and Postural Assessment Scale.** The intervention was given everyday for 5 days a week for 45min to 1 hour based on the pilates protocol formed according to the reference articles and the intervention was followed for a duration of 8 weeks. The post test value was recorded after a duration of 8 weeks and the difference in the test values were measured.

For balance **PEDIATRIC BALANCE SCALE** is used whereas for posture **POSTURE AND POSTURAL ASSESSMENT SCALE** is used. **GMFM-88** is used to assess gross motor functional ability. Balance and posture are the key parameters for the study.

Pilates intervention is given for a duration of 8 weeks which included an exercise protocol of 12 exercises ; 4 set of exercise each in supine , sitting and standing. The exercise protocol is as follows

In supine

1. **Straight leg raise (30 degree)**

2. **Single leg circle**

3. **Pelvic bridging**

4. **Alternate toe touch**

In sitting

1. **Trunk rotation**

2. **Ball leg lift**

3. **Mermaid side sitting with side flexion**

4. **Quadripod cat and camel**

In standing

1. Single leg stand other leg moving

2. Ball wall squat (half)

3.Step up and down

4. Bending forward with knee bend

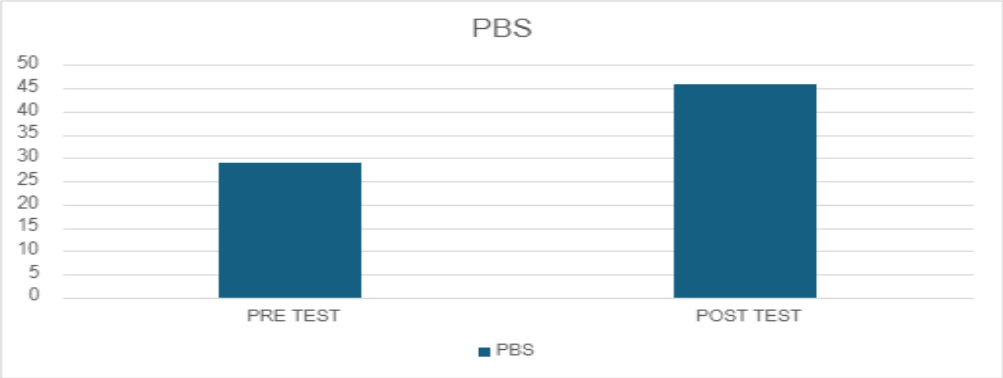
OUTCOME

After the intervention, there was significant improvement in the score of Pediatric Balance Scale from 29 to 46 represented in table 1 and presented in graph 1. This shows that there is significant improvement in the balance of the child and shows that pilates intervention helps significantly in improving the balance of athetoid child.

Table 1: Represents the pre and post-test of Pediatric Balance scale

	PRE-TEST	POST-TEST
PBS	29	46

Graph 1: Represents the pre and post-test of Pediatric Balance scale

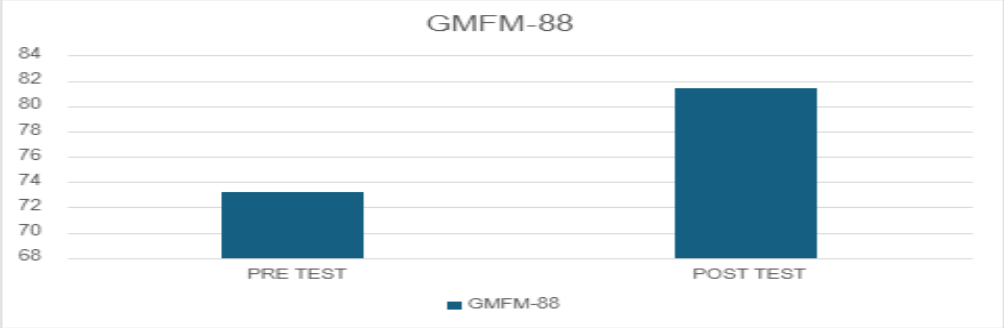


There was significant improvement in the gross motor functional ability of the child after following the pilates protocol. The overall GMFM-88 score increased from 73.2 to 81.4 which shows that there was marked changes in the gross motor function of the child. The gmfm-88 scores are presented in table 2 as well as shown in graphical presentation in graph 2.

Table 2: Represents the pre and post-test of GMFM-88

	PRE-TEST	**POST-TEST**
GMFM-88	73.2	81.4

Graph 2: Represents the pre and post-test of GMFM-88

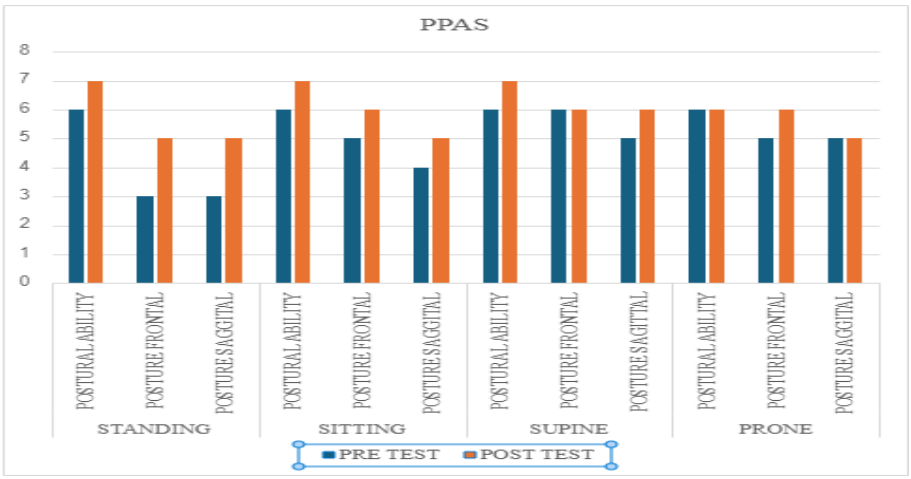


There was also improvement in the postural parameters in the PPAS scale. The table 3 represents the pre and post test values of the posture in standing, sitting, supine and prone in the frontal and sagittal plane along with the postural ability. The improvements in the postural parameters is depicted in the graph 3.

Table 3: Represents the pre and post test of PPAS

		PRE TEST	POST TEST
STANDING	POSTURAL ABILITY	LEVEL 6	LEVEL 7
	POSTURAL FRONTAL	3	5
	POSTURAL SAGGITAL	3	5
SITTING	POSTURAL ABILITY	LEVEL 6	LEVEL 7
	POSTURAL FRONTAL	5	6
	POSTURAL SAGGITAL	4	5
SUPINE	POSTURAL ABILITY	LEVEL 6	LEVEL 7
	POSTURAL FRONTAL	6	6
	POSTURAL SAGGITAL	5	6
PRONE	POSTURAL ABILITY	LEVEL 6	LEVEL 7
	POSTURAL SAGGITAL	5	6
	POSTURAL FRONTAL	5	5

Graph 3: Represents the pre and post-test of PPAS



DISCUSSION

Pilates is a low-impact exercise method that emphasizes the strengthening of core muscles, improving flexibility, and enhancing body awareness. For children with athetoid cerebral palsy, these elements are particularly crucial. The core muscles play a vital role in maintaining posture and balance, which are often compromised in these children due to their condition. Engaging in Pilates can help the child develop better control over their movements, leading to improved stability and a reduced risk of falls. This aligns with findings from previous studies that highlight the importance of core stability in enhancing functional outcomes for children with cerebral palsy .

Pilates intervention was not performed for athetoid cerebral palsy, so a single athetoid cerebral palsy child is selected based on the inclusion and exclusion criteria, following which the pre test was taken based on the **GMFM-88**, **PPAS** and **PBS.** After the pre test the intervention started for a period of about 8 weeks 5 days a week for 45min to 1 hr duration. The study is conducted as an experimental study because there was a need to study the effects of pilates on the athetoid cerebral palsy. After the pilates intervention the post test was taken which showed marked significant changes in the parameters of posture, balance and gross motor function in the athetoid cerebral palsy child

The study highlights that Pilates exercises can significantly enhance postural alignment. Proper alignment is essential for individuals with cerebral palsy, as it can alleviate secondary complications such as musculoskeletal deformities and pain. The controlled movements inherent in Pilates encourage the child to focus on their body positioning, which can translate into better postural control in daily activities. Improved balance is another critical outcome, as it directly impacts the child's ability to engage in physical activities and interact with their environment. This is particularly important given that balance disorders are a significant challenge for children with athetoid cerebral palsy, complicating their ability to attain and sustain equilibrium.

The study finding showed an increase in **GMFM-88** from 73.2 to 81.4 . There is also significant improvement in the balance scores in **PBS,** increasing from 29 to 46.The findings are consistent with existing literature Farjad Afzal et al (2019) that emphasizes the benefits of physical therapy interventions for children with cerebral palsy. For instance, studies have shown that various forms of physical therapy, including treadmill training and trunk strengthening exercises, lead to significant improvements in **gross motor function** and **balance** . The integration of Pilates into the therapeutic regimen can be seen as a complementary approach that enhances these outcomes by focusing on core stability and controlled movement patterns.

There is marked improvement in posture ability scores in the **PPAS**, increasing from level 6 to level 7 in all the position (standing, sitting, supine & prone). Additionally, research has demonstrated that Pilates can enhance lower limb strength and posture control, Adriana Neves Dos Santos et al (2014) further supporting its efficacy in this population.

While the study presents promising results, it is essential to acknowledge its limitations. The duration of the intervention was only eight weeks, which may not be sufficient to observe long-term benefits. Additionally, the study involved a single participant, limiting the generalizability of the findings. Future research should consider a larger sample size and a longer intervention period to validate the effectiveness of Pilates. Furthermore, comparing Pilates with other therapeutic interventions could provide a clearer understanding of its unique contributions to rehabilitation. This is particularly relevant given the diverse needs of children with cerebral palsy and the varying degrees of motor impairment they may experience .

Based on the findings, it is recommended that physiotherapists consider incorporating Pilates into their treatment plans for children with athetoid cerebral palsy. Tailoring Pilates exercises to meet the individual needs of each child can enhance engagement and motivation. Additionally, training for therapists in Pilates techniques could improve the quality of care provided to these children. This aligns with the need for personalized rehabilitation strategies that address the specific challenges faced by children with cerebral palsy.

In conclusion, the study on the effectiveness of Pilates for improving posture and balance in a child with athetoid cerebral palsy underscores the potential of this exercise method as a valuable therapeutic tool. By focusing on core strength, flexibility, and body awareness, Pilates can contribute to enhanced functional outcomes for children with cerebral palsy. Continued research and clinical practice in this area will be essential for optimizing rehabilitation strategies and improving the quality of life for affected individuals. The integration of Pilates into therapeutic interventions represents a promising avenue for enhancing the rehabilitation process for children with motor impairments, ultimately leading to better health outcomes and improved quality of life.

CONCLUSION

The study highlights the effectiveness of Pilates in improving posture and balance in children with athetoid cerebral palsy, demonstrating its ability to enhance core strength, flexibility, and body awareness—key factors for maintaining stability. By focusing on core stability and controlled movement, Pilates shows promise as a valuable therapeutic tool, contributing to better functional outcomes and quality of life. Further exploration and clinical application are essential to fully integrate Pilates into rehabilitation strategies for this population.

LIMITATION AND RECOMMENDATION

LIMITATIONS

- Duration of the study was 8 weeks. It could be longer in case of cp to accomplish considerable outcome
- The study could have benefited from a larger sample size to achieve more favorable results.
- Pilates was not compared with other intervention and no control group was used

RECOMMENDATIONS

- Duration of the study can be increased
- A control group can be added
- A different intervention can be compared with pilates

REFERENCES

1. Abd-Elfattah, H. M., Galal, D. O. S. M., Aly, M. I. E., Aly, S. M., & Elnegamy, T. E. (2022). Effect of Pilates Exercises on Standing, Walking, and Balance in Children With Diplegic Cerebral Palsy. Annals of rehabilitation medicine, 46(1), 45–52. https://doi.org/10.5535/arm.21148
2. Wimalasundera, N., & Stevenson, V. L. (2016). Cerebral palsy. Practical neurology, 16(3), 184–194. https://doi.org/10.1136/practneurol-2015-001184
3. Kato, S., Shoda, N., Chikuda, H., Seichi, A., & Takeshita, K. (2014). Morphological characteristics of cervical spine in patients with athetoid cerebral palsy and the accuracy of pedicle screw placement. Spine, 39(8), E508–E513. https://doi.org/10.1097/BRS.0000000000000234
4. Cans, Christine & De-la-Cruz, Javier & Mermet, Marie-Ange. (2008). Epidemiology of cerebral palsy. Paediatrics and Child Health. 18. 393-398. 10.1016/j.paed.2008.05.015.
5. Amor, D. J., Craig, J. E., Delatycki, M. B., & Reddihough, D. (2001). Genetic factors in athetoid cerebral palsy. Journal of child neurology, 16(11), 793–797. https://doi.org/10.1177/088307380101601103 01
6. Emara, H. A., El-Gohary, T. M., & Al-Johany, A. A. (2016). Effect of body-weight suspension training versus treadmill training on gross motor abilities of children with spastic diplegic cerebral palsy. European journal of physical and rehabilitation medicine, 52(3), 356–363.
7. Brien, M., & Sveistrup, H. (2011). An intensive virtual reality program improves functional balance and mobility of adolescents with cerebral palsy. Pediatric physical therapy : the official publication of the Section on Pediatrics of the American Physical Therapy Association, 23(3), 258–266. https://doi.org/10.1097/PEP.0b013e318227ca0f
8. Sato H. Postural deformity in children with cerebral palsy: Why it occurs and how is it managed. Phys Ther Res. 2020 Jun 20;23(1):8-14. doi: 10.1298/ptr.R0008. PMID: 32850273; PMCID: PMC7344367.
9. Abd-Elfattah, H. M., Galal, D. O. S. M., Aly, M. I. E., Aly, S. M., & Elnegamy, T. E. (2022). Effect of Pilates Exercises on Standing, Walking, and Balance in Children With Diplegic Cerebral Palsy. Annals of rehabilitation medicine, 46(1), 45–52. https://doi.org/10.5535/arm.21148
10. van der Linden ML, Bulley C, Geneen LJ, Hooper JE, Cowan P, Mercer TH. Pilates for people with mul tiple sclerosis who use a wheelchair: feasibility, ef ficacy and participant experiences. Disabil Rehabil 2014;36:932-9.

11. Guclu-Gunduz A, Citaker S, Irkec C, Nazliel B, Batur Caglayan HZ. The effects of Pilates on balance, mobil ity and strength in patients with multiple sclerosis. NeuroRehabilitation 2014;34:337-42.
12. Irez GB, Ozdemir RA, Evin R, Irez SG, Korkusuz F. In tegrating Pilates exercise into an exercise program for 65+ year-old women to reduce falls. J Sports Sci Med 2011;10:105-11.
13. Mohammadi M, Kaldirimci M, Kazemi SE, Mizrak O, Tugrulhansam C. The effect of Pilates exercise on gait speed and strength of lower limb in elderly male. Adv Appl Sci Res 2015;6:1-6.
14. Phrompaet S, Paungmali A, Pirunsan U, Sitilertpisan P. Effects of Pilates training on lumbo-pelvic stability and flexibility. Asian J Sports Med 2011;2:16-22.
15. Culligan PJ, Scherer J, Dyer K, Priestley JL, Guingon White G, Delvecchio D, et al. A randomized clinical trial comparing pelvic floor muscle training to a Pi lates exercise program for improving pelvic muscle strength. Int Urogynecol J 2010;21:401-8.
16. Dos Santos AN, Serikawa SS, Rocha NA. Pilates im proves lower limbs strength and postural control during quite standing in a child with hemiparetic cerebral palsy: a case report study. Dev Neurorehabil 2016;19:226-30.
17. Bahramizadeh M, Mousavi ME, Rassafiani M, Amin ian G, Ebrahimi I, Karimlou M, et al. The effect of floor reaction ankle foot orthosis on postural control in children with spastic cerebral palsy. Prosthet Orthot Int 2012;36:71-6.
18. Kish R. The functional effects of Pilates training on dancers [dissertation]. Long Beach, CA: California State University; 1998.
19. Rydeard R, Leger A, Smith D. Pilates-based thera peutic exercise: effect on subjects with nonspecific chronic low back pain and functional disability: a ran domized controlled trial. J Orthop Sports Phys Ther 2006;36:472-84.
20. Liao HF, Liu YC, Liu WY, Lin YT. Effectiveness of load ed sit-to-stand resistance exercise for children with mild spastic diplegia: a randomized clinical trial. Arch Phys Med Rehabil 2007;88:25-31.
21. Levine B, Kaplanek B, Scafura D, Jaffe WL. Rehabili tation after total hip and knee arthroplasty: a new regimen using Pilates training. Bull NYU Hosp Jt Dis 2007;65:120-5.
22. Latey P. The Pilates method: history and philosophy. J Bodyw Mov Ther 2001;5:275-82.
23. Surbala L, Khuman PR, Trivedi P, Devanshi B, Mital V. Pilates versus conventional balance training on func tional balance and quality of life in elderly individu als: a randomized controlled study. Sch J App Med Sci 2014;2(1B):221-6.
24. Safei I, Moeliono MA, Prabowo T. Loaded and un loaded sit-to-stand strengthening exercises effect to gross motor function measure in spastic diplegia ce rebral palsy patients. Int J Integr Health Sci 2016;4:8 14.
25. Franjoine MR, Darr N, Held SL, Kott K, Young BL. The performance of children developing typically on the pediatric balance scale. Pediatr Phys Ther 2010;22:350-9.
26. Chen CL, Shen IH, Chen CY, Wu CY, Liu WY, Chung CY. Validity, responsiveness, minimal detectable change, and minimal clinically important change of Pediatric Balance Scale in children with cerebral palsy. Res Dev Disabil 2013;34:916-22.

27. 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;39:214-23.

28. Hennington G, Johnson J, Penrose J, Barr K, Mc Mulkin ML, Vander Linden DW. Effect of bench height on sit-to-stand in children without disabilities and children with cerebral palsy. Arch Phys Med Rehabil 2004;85:70-6.

29. Sekendiz B, Cug M, Korkusuz F. Effects of Swiss-ball core strength training on strength, endurance, flex ibility, and balance in sedentary women. J Strength Cond Res 2010;24:3032-40.

30. da Fonseca JL, Magini M, de Freitas TH. Labora tory gait analysis in patients with low back pain be fore and after a Pilates intervention. J Sport Rehabil 2009;18:269-82.

31. Curnow D, Cobbin D, Wyndham J, Boris Choy ST. Al tered motor control, posture and the Pilates method of exercise prescription. J Bodyw Mov Ther 2009;13:104 11.

32. Bird ML, Hill KD, Fell JW. A randomized controlled study investigating static and dynamic balance in older adults after training with Pilates. Arch Phys Med Rehabil 2012;93:43-9.

33. Emery K, De Serres SJ, McMillan A, Cote JN. The ef fects of a Pilates training program on arm-trunk pos ture and movement. Clin Biomech (Bristol, Avon) 2010;25:124-30.

34. Wells C, Kolt GS, Bialocerkowski A. Defining Pilates exercise: a systematic review. Complement Ther Med 2012;20:253-62.

35. Keays KS, Harris SR, Lucyshyn JM, MacIntyre DL. Ef fects of Pilates exercises on shoulder range of motion, pain, mood, and upper-extremity function in women living with breast cancer: a pilot study. Phys Ther 2008;88:494-510.

36. Mokhtari M, Nezakatalhossaini M, Esfarjani F. The effect of 12-week Pilates exercises on depression and balance associated with falling in the elderly. Proce dia Soc Behav Sci 2013;70:1714-23.

37. Newell D, Shead V, Sloane L. Changes in gait and balance parameters in elderly subjects attending an 8-week supervised Pilates programme. J Bodyw Mov Ther 2012;16:549-54.

38. Brien M, Sveistrup H. An intensive virtual reality program improves functional balance and mobility of adolescents with cerebral palsy. Pediatr Phys Ther 2011;23:258-66.

39. Emara HA, El-Gohary TM, Al-Johany AA. Effect of body-weight suspension training versus treadmill training on gross motor abilities of children with spas tic diplegic cerebral palsy. Eur J Phys Rehabil Med 2016;52:356-63

40. Guy JA, Micheli LJ. Strength training for children and adolescents. J Am Acad Orthop Surg 2001;9:29-36.

41. Richards CL, Malouin F. Cerebral palsy: definition, assessment and rehabilitation. Handb Clin Neurol 2013;111:183-95.

ANNEXURE 1

CONSENT FORM

I SUBRAT JENA, BPT final year student from the Department Of Therapeutics, College of Physiotherapy, NIEPMD is doing a study on "EFFECTIVENESS OF PILATES EXERCISE ON THE POSTURE AND BALANCE OF AN ATHETOID CEREBRAL PALSY CHILDREN . A CASE STUDY". The purpose of this study is to find that whether pilates would be effective in improving balance and posture in children with Athetoid Cerebral Palsy. With your permission, I will be collecting your child's details. Your child will be asked to participate in a series of Pilates exercise. Your child's performance and progress will be assessed before and after the intervention session using standardized tool. The research will be conducted over a period of 8 weeks.

Kindly be assured that your child's identity and all data collected during the study will be kept confidential. Your child's name will not be published in any report or academic paper. There are no known risks associated with participation in this study. Participation in this study is voluntary, and your child have the right to withdraw from the study at any point without any consequences. By acknowledging these you are requested to sign this consent form.

I_____ parent of _____ voluntarily agree to participate in this study. The procedure of this study has been explained to me. I am aware that, I can discontinue this study at any point of time and also my doubts have been clarified to my satisfaction.

NAME OF THE CHILD:

NAME OF THE PARENT/GUARDIAN:

SIGNATURE OF PARENT/GUARDIAN:

DATE:

PLACE:

ANNEXURE 2

A

PEDIATRIC BALANCE SCALE

Name: _____ Date: _____

Location: _____ Examiner: _____

Item Description		Score *0 - 4*	Seconds *optional*
1.	Sitting to standing	_____	
2.	Standing to sitting	_____	
3.	Transfers	_____	
4.	Standing unsupported	_____	_____
5.	Sitting unsupported	_____	_____
6.	Standing with eyes closed	_____	_____
7.	Standing with feet together	_____	_____
8.	Standing with one foot in front	_____	_____
9.	Standing on one foot	_____	_____
10.	Turning 360 degrees	_____	_____
11.	Turning to look behind	_____	
12.	Retrieving object from floor	_____	
13.	Placing alternate foot on stool	_____	_____
14.	Reaching forward with outstretched arm	_____	
	Total Test Score	_____	

General Instructions

1. Demonstrate each task and give instructions as written. A child may receive a practice trial on each item. If the child is unable to complete the task based on their ability to understand the directions, a second practice trial may be given. Verbal and visual directions may be clarified through the use of physical prompts.

2. Each item should be scored utilizing the 0 to 4 scale. Multiple trials are allowed on many of the items. The child's performance should be scored based upon the lowest criteria, which describes the child's best performance. If on the first trial a child receives the maximal score of 4, additional trials need not be administered. Several items require the child to maintain a given position for a specific time. Progressively, more points are deducted if the time or distance requirements are not met; if the subject's performance warrants supervision; or if the subject touches an external support or receives assistance from the examiner. Subjects should understand that they must maintain their balance while attempting the tasks. The choice, of which leg stand on or how far to reach, is left to the subject. Poor judgement will adversely influence the performance and the scoring. In addition to scoring items 4, 5, 6, 7, 8, 9, 10, and 13, the examiner may choose to record the exact time in seconds.

Figure. No caption available.

B

Equipment

The Pediatric Balance Scale was designed to require minimal use of specialized equipment. The following is a complete list of items required for administration of this tool:

adjustable height bench
chair with back support and arm rests
stopwatch or watch with a second hand
masking tape - 1inch wide
a step stool 6 inches in height
chalkboard eraser
ruler or yardstick
a small level

The following items are optional and may be helpful during test administration:

2 child-size footprints
blindfold
a brightly colored object of at least two inches in size
flash cards
2 inches of adhesive-backed hook Velcro
Two 1 foot strips of loop Velcro

****

1. **Sitting To Standing**

* ***Special instruction***: *Items #1 and #2 may be tested simultaneously if, in the determination of the examiner, it will facilitate the best performance of the child.*

INSTRUCTIONS: **Child is asked to "Hold arms up and stand up."** The child is allowed to select the position of his/her arms.

EQUIPMENT: A bench of appropriate height to allow the child's feet to rest supported on the floor with the hips and knees maintained in 90 degrees of flexion.

Best Of Three Trials

( ) 4 able to stand without using hands and stabilize independently
( ) 3 able to stand independently using hands
( ) 2 able to stand using hands after several tries
( ) 1 needs minimal assist to stand or to stabilize
( ) 0 needs moderate or maximal assist to stand

Figure. No caption available.

c

2. **Standing To Sitting**

** **Special instruction**: Items #1 and #2 may be tested simultaneously if, in the determination of the examiner, it will facilitate the best performance of the child.*

INSTRUCTIONS: **Child is asked to sit down slowly, without use of hands.** The child is allowed to select the position of his/her arms.

EQUIPMENT: A bench of appropriate height to allow the child's feet to rest supported on the floor with the hips and knees maintained in 90 degrees of flexion.

Best Of Three Trials

( ) 4	sits safely with minimal use of hands
( ) 3	controls descent by using hands
( ) 2	uses back of legs against chair to control descent
( ) 1	sits independently, but has uncontrolled descent
( ) 0	needs assistance to sit

3. **Transfers**

INSTRUCTIONS: Arrange chair(s) for a stand pivot transfer, touching at a forty-five degree angle. **Ask the child to transfer one way toward a seat with armrests and one way toward a seat without armrests.**

Equipment: Two chairs, or one chair and one bench. One seating surface must have armrests. One chair/bench should be of standard adult size and the other should be of an appropriate height to allow the child to conformably sit with feet supported on the floor and ninety degrees of hip and knee flexion.

Best Of Three Trials

( ) 4	able to transfer safely with minor use of hands
( ) 3	able to transfer safely; definite need of hands
( ) 2	able to transfer with verbal cueing and/or supervision (spotting)
( ) 1	needs one person to assist
( ) 0	needs two people to assist or supervise (close guard) to be safe

Figure. No caption available.

D

4. **Standing Unsupported**

INSTRUCTIONS: **The child is asked to stand for 30 SECONDS without holding on or moving his/her feet.** A taped line or footprints may be placed on the floor to help the child maintain a stationary foot position. The child may be engaged in non-stressful conversation to maintain attention span for thirty seconds. Weight shifting and equilibrium responses in feet are acceptable; movement of the foot in space (off the support surface) indicates end of the timed trial.

EQUIPMENT: a stop watch or watch with a second hand
a twelve inch long masking tape line or two footprints placed shoulder width apart

( )4 able to stand safely 30 SECONDS
( )3 able to stand 30 SECONDS with supervision (spotting)
( )2 able to stand 15 SECONDS unsupported
( )1 needs several tries to stand 10 SECONDS unsupported
( )0 unable to stand 10 SECONDS unassisted

____**Time in seconds**

Special Instructions: If a subject is able to stand 30 SECONDS unsupported, score full points for sitting unsupported. Proceed to item #6

5. **Sitting With Back Unsupported And Feet Supported On The Floor**

INSTRUCTIONS: **Please sit with arms folded on your chest for 30 SECONDS**. Child may be engaged in non-stressful conversation to maintain attention span for thirty seconds. Time should be stopped if protective reactions are observed in trunk or upper extremities.

EQUIPMENT: a stop watch or watch with a second hand
a bench of appropriate height to allow the feet to rest supported on the floor with the hips and knees maintained in ninety degrees of flexion.

( )4 able to sit safely and securely 30 SECONDS
( )3 able to sit 30 SECONDS under supervision (spotting) or may require definite use of upper extremities to maintain sitting position
( )2 able to sit 15 SECONDS
( )1 able to sit 10 SECONDS
( )0 unable to sit 10 SECONDS without support

____ **Time in seconds**

Figure. No caption available.

E

6. **Standing Unsupported With Eyes Closed**

INSTRUCTIONS: The child is asked to stand still with feet shoulder width apart and close his/her eyes for ten seconds. **Direction: "When I say close your eyes, I want you to stand still, close your eyes, and keep them closed until I say open."** If necessary, a blindfold may be used. Weight shifting and equilibrium responses in the feet are acceptable; movement of the foot in space (off the support surface) indicates end of timed trial. A taped line or footprints may be placed on the floor to help the child maintain a stationary foot position.

EQUIPMENT: a stop watch or watch with a second hand
a twelve-inch long masking tape line or two footprints placed shoulder width apart
blindfold

Best Of 3 Trials,

( ) 4 able to stand 10 seconds safely
( ) 3 able to stand 10 seconds with supervision (spotting)
( ) 2 able to stand 3 seconds
( ) 1 unable to keep eyes closed 3 seconds but stays steady
( ) 0 needs help to keep from falling

____ **Time in seconds**

7. **Standing Unsupported With Feet Together**

INSTRUCTIONS: **The child is asked to place his/her feet together and stand still without holding on**. The child may be engaged in non-stressful conversation to maintain attention span for thirty seconds. Weight shifting and equilibrium responses in feet are acceptable; movement of the foot in space (off the support surface) indicates end of timed trial. A taped line or footprints may be placed on the floor to help the child maintain stationary foot position.

EQUIPMENT: a stop watch or watch with a second hand
a twelve inch long masking tape line or two footprints placed together

Best Of 3 Trials

( ) 4 able to place feet together independently and stand 30 seconds safely
( ) 3 able to place feet together independently and stand for 30 seconds with supervision (spotting)
( ) 2 able to place feet together independently but unable to hold for 30 seconds
( ) 1 needs help to attain position but able to stand 30 seconds with feet together
( ) 0 needs help to attain position and/or unable to hold for 30 seconds

____ **Time in seconds**

Figure. No caption available.

F

8. **Standing Unsupported One Foot In Front**

INSTRUCTIONS: **The child is asked to stand with one foot in front of the other, heel to toe.** If the child cannot place feet in a tandem position (directly in front), they should be asked to step forward far enough to allow the heel of one foot to be placed ahead of the toes of the stationary foot. A taped line and/or footprints may be placed on the floor to help the child maintain a stationary foot position. In addition to a visual demonstration, a single physical prompt (assistance with placement) may be given. The child may be engaged in non-stressful conversation to maintain his/her attention span for 30 seconds. Weight shifting and/or equilibrium reactions in the feet are acceptable. Timed trials should be stopped if either foot moves in space (leaves the support surface) and/or upper extremities support is utilized.

EQUIPMENT: a stop watch or watch with a second hand
a twelve inch long masking tape line or two footprints placed heel to toe

Best Of Three Trials

( ) 4 able to place feet tandem independently and hold 30 seconds
( ) 3 able to place foot ahead of other independently and hold 30 seconds.
Note: The length of the step must exceed the length of the stationary foot and the width of the stance should approximate the subject's normal stride width.
( ) 2 able to take small step independently and hold 30 seconds, or required assistance to place foot in front, but can stand for 30 seconds.
( ) 1 needs help to step, but can hold 15 seconds
( ) 0 loses balance while stepping or standing

_____ **Time in seconds**

9. **Standing On One Leg**

INSTRUCTIONS: **The child is asked to stand on one leg for as long as he/she is able to without holding on.** If necessary the child can be instructed to maintain his/her arms (hands) on his/her hips (waist). A taped line or footprints may be placed on the floor to help the child maintain a stationary foot position. Weight shifting and/or equilibrium reactions in the feet are acceptable. Timed trials should be stopped if the weight-bearing foot moves in space (leaves the support surface), the up limb touches the opposite leg or the support surface and/or upper extremities are utilized for support.

EQUIPMENT: a stop watch or watch with a second hand
a twelve inch long masking tape line or two footprints placed heel to toe

3 Trials Average Score

( ) 4 able to lift leg independently and hold 10 seconds
( ) 3 able to lift leg independently and hold 5 to 9 seconds
( ) 2 able to lift leg independently and hold 3 to 4 seconds
( ) 1 tries to lift leg; unable to hold 3 seconds but remains standing
( ) 0 unable to try or needs assist to prevent fall

Figure. No caption available.

G

10. **Turn 360 Degrees**

INSTRUCTIONS: **The child is asked to turn completely around in a full circle, STOP, and then turn a full circle in the other direction.**

EQUIPMENT: A stop watch or watch with a second hand

( )4 able to turn 360 degrees safely in 4 seconds or less each way (total of less than eight seconds)
( )3 able to turn 360 degrees safely in one direction only in 4 seconds or less completes turn in other direction requires more than four seconds
( )2 able to turn 360 degrees safely but slowly
( )1 needs close supervision (spotting) or constant verbal cueing
( )0 needs assistance while turning

____ **Time in seconds**

11. **Turning To Look Behind Left & Right Shoulders While Standing Still**

INSTRUCTIONS: **The child is asked to stand with his/her feet still, fixed in one place. "Follow this object as I move it. Keep watching it as I move it, but don't move your feet."**

EQUIPMENT: a brightly colored object of at least two inches in size, or flash cards
a twelve inch long masking tape line or two footprints placed shoulder width apart

( )4 looks behind/over each shoulder; weight shifts include trunk rotation
( )3 looks behind/over one shoulder with trunk rotation; weight shift in the opposite direction is to the level of the shoulder; no trunk rotation
( )2 turns head to look to level of shoulder; no trunk rotation
( )1 needs supervision (spotting) when turning; the chin moves greater than half the distance to the shoulder
( )0 needs assist to keep from losing balance or falling; movement of the chin is less than half the distance to the shoulder

12. **Pick Up Object From The Floor From A Standing Position**

INSTRUCTIONS: **The child is asked to pick up a chalkboard eraser placed approximately the length of his/her foot in front of his/her dominant foot.** In children, where dominance is not clear, ask the child which hand they want to use and place the object in front of that foot.

EQUIPMENT: a chalkboard eraser
a taped line or footprints

( )4 able to pick up an eraser safetly and easily
( )3 able to pick up eraser but needs supervision (spotting)
( )2 unable to pick up eraser but reaches 1 to 2 nches from eraser and keeps balance independently
( )1 unable to pick up eraser; needs supervision (spotting) while attempting
( )0 unable to try, needs assist to keep from losing balance or falling

Figure. No caption available.

H

13. **Placing Alternate Foot On Step Stool While Standing Unsupported**

INSTRUCTIONS: **The child is asked to place each foot alternately on the step stool and to continue until each foot has touched the step/stool four times.**

EQUIPMENT: a step/stool of four inches in height
a stop watch or watch with a second hand.

( )4 stands independently and safely and completes 8 steps in 20 seconds
( )3 able to stand independently and complete 8 steps >20 seconds
( )2 able to complete 4 steps without assistance, but requires close supervision (spotting)
( )1 able to complete 2 steps; needs minimal assistance
( )0 needs assistance to maintain balance or keep from falling, unable to try

____ **Time in seconds**

14. **Reaching Forward With Outstretched Arm While Standing**

General Instruction And Set Up: A yardstick affixed to a wall via Velcro strips will be used as the measuring tool. A taped line and/or footprints are used to maintain a stationary foot position. The child will be asked to reach as far forward without falling, and without stepping over the line. The MCP joint of the child's fisted hand will be used as the anatomical reference point for measurements. Assistance may be given to initially position the child's arm at 90 degrees. Support may not be provided during the reaching process. If 90 degrees of shoulder flexion cannot be obtained, then this item should be omitted.

INSTRUCTIONS: **The child is asked to lift his/her arm up like this. "Stretch out your fingers, make a fist, and reach forward as far as you can without moving your feet."**

3 Trials Average Results

EQUIPMENT: a yardstick or ruler
a taped line or footprints
a level

( )4 can reach forward confidently >10 inches
( )3 can reach forward >5 inches, safely
( )2 can reach forward >2 inches, safely
( )1 reaches forward but needs supervision (spotting)
( )0 loses balance while trying, requires external support

____ **Total Test Score**
Maximum Score = 56

Figure. No caption available.

TABLE 1.

The Berg Balance Scale and the Pediatric Balance Scale

	Berg's Balance Scale Items		Pediatric Balance Scale Items
1	Sitting to standing	1	Sitting to standing
2	Standing unsupported	2	Standing to sitting
3	Sitting unsupported	3	Transfers
4	Standing to sitting	4	Standing unsupported
5	Transfers	5	Sitting unsupported
6	Standing with eyes closed	6	Standing with eyes closed
7	Standing with feet together	7	Standing with feet together
8	Reaching forward with outstretched arm	8	Standing with one foot in front
9	Retrieving object from floor	9	Standing on one foot
10	Turning to look behind	10	Turning 360 degrees
11	Turning 360 degrees	11	Turning to look behind
12	Placing alternate foot on stool	12	Retrieving object from floor
13	Standing with one foot in front	13	Placing alternate foot on stool
14	Standing on one foot	14	Reaching forward with outstretched arm

TABLE 1. The Berg Balance Scale and the Pediatric Balance Scale

ANNEXURE 3

Posture and Postural Ability Scale (PPAS)

Name: _____ **GMFCS Level:** I II III IV V

STANDING

Equipment/Support: _____

Postural Ability		
	Level 1	Unplaceable in an aligned posture
	Level 2	Placeable in an aligned posture but needs support
	Level 3	Able to maintain position when placed but cannot move
	Level 4	Able to initiate flexion/extension of trunk
	Level 5	Able to transfer weight laterally and regain posture
	Level 6	Able to move out of position
	Level 7	Able to move into and out of position

Quality of Posture		
View	**0/1**	**Comment**
Frontal		
Head midline		
Trunk symmetrical		
Pelvis neutral		
Legs separated & straight relative to pelvis		
Arms resting by side		
Weight evenly distributed		
FRONTAL SUBTOTAL		
Sagittal		
Head midline		
Trunk in neutral position		
Pelvis neutral		
Legs straight, hips/knees extended		
Feet mid-position/flat on floor		
Weight evenly distributed		
SAGITTAL SUBTOTAL		
QUALITY TOTAL		

Source: Rodby-Bousquet, E., Ágústsson, A., Jónsdóttir, G., Czuba, T., Johansson, A. C., & Hägglund, G. (2014). Interrater reliability and construct validity of the Posture and Postural Ability Scale in adults with cerebral palsy in supine, prone, sitting and standing positions. Clinical rehabilitation, 28(1), 82-90.
Note that this is not an official PPAS form. This form was created by www.ApplyEBP.com | applyebp@gmail.com

Posture and Postural Ability Scale (PPAS)

Name: _____ **GMFCS Level:** I II III IV V

SITTING

Equipment/Support: _____

Postural Ability		
	Level 1	Unplaceable in an aligned posture
	Level 2	Placeable in an aligned posture but needs support
	Level 3	Able to maintain position when placed but cannot move
	Level 4	Able to initiate flexion/extension of trunk
	Level 5	Able to transfer weight laterally and regain posture
	Level 6	Able to move out of position
	Level 7	Able to move into and out of position

Quality of Posture		
View	**0/1**	**Comment**
Frontal		
Head midline		
Trunk symmetrical		
Pelvis neutral		
Legs separated & straight relative to pelvis		
Arms resting by side		
Weight evenly distributed		
FRONTAL SUBTOTAL		
Sagittal		
Head midline		
Trunk in neutral position		
Pelvis neutral		
Hips mid-position (90^0)		
Knees mid-position (90^0)		
Feet mid-position/flat on floor		
SAGITTAL SUBTOTAL		
QUALITY TOTAL		

Source: Rodby-Bousquet, E., Ágústsson, A., Jónsdóttir, G., Czuba, T., Johansson, A. C., & Hägglund, G. (2014). Interrater reliability and construct validity of the Posture and Postural Ability Scale in adults with cerebral palsy in supine, prone, sitting and standing positions. Clinical rehabilitation, 28(1), 82-90.
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Posture and Postural Ability Scale (PPAS)

Name: _____ **GMFCS Level:** I II III IV V

SUPINE

Equipment/Support: _____

Postural Ability		
	Level 1	Unplaceable in an aligned posture
	Level 2	Placeable in an aligned posture but needs support
	Level 3	Able to maintain position when placed but cannot move
	Level 4	Able to initiate flexion/extension of trunk
	Level 5	Able to transfer weight laterally and regain posture
	Level 6	Able to move out of position
	Level 7	Able to move into and out of position

Quality of Posture		
View	**0/1**	**Comment**
Frontal		
Head midline		
Trunk symmetrical		
Pelvis neutral		
Legs separated & straight relative to pelvis		
Arms resting by side		
Weight evenly distributed		
FRONTAL SUBTOTAL		
Sagittal		
Head midline		
Trunk in neutral position		
Pelvis neutral		
Legs straight, hips/knees extended		
Feet resting in normal position		
Weight evenly distributed		
SAGITTAL SUBTOTAL		
QUALITY TOTAL		

Source: Rodby-Bousquet, E., Ágústsson, A., Jónsdóttir, G., Czuba, T., Johansson, A. C., & Hägglund, G. (2014). Interrater reliability and construct validity of the Posture and Postural Ability Scale in adults with cerebral palsy in supine, prone, sitting and standing positions. Clinical rehabilitation, 28(1), 82-90.
Note that this is not an official PPAS form. This form was created by www.ApplyEBP.com | applyebp@gmail.com

Posture and Postural Ability Scale (PPAS)

Name: _____ **GMFCS Level:** I II III IV V

PRONE

Equipment/Support: _____

Postural Ability		
	Level 1	Unplaceable in an aligned posture
	Level 2	Placeable in an aligned posture but needs support
	Level 3	Able to maintain position when placed but cannot move
	Level 4	Able to initiate flexion/extension of trunk
	Level 5	Able to transfer weight laterally and regain posture
	Level 6	Able to move out of position
	Level 7	Able to move into and out of position

Quality of Posture		
View	**0/1**	**Comment**
Frontal		
Head to one side		
Trunk symmetrical		
Pelvis neutral		
Legs separated & straight relative to pelvis		
Arms resting (elevated, mid-position)		
Weight evenly distributed		
FRONTAL SUBTOTAL		
Sagittal		
Trunk in neutral position		
Pelvis neutral		
Hips extended		
Knees extended		
Arms resting (elevated, mid-position)		
Weight evenly distributed		
SAGITTAL SUBTOTAL		
QUALITY TOTAL		

Source: Rodby-Bousquet, E., Ágústsson, A., Jónsdóttir, G., Czuba, T., Johansson, A. C., & Hägglund, G. (2014). Interrater reliability and construct validity of the Posture and Postural Ability Scale in adults with cerebral palsy in supine, prone, sitting and standing positions. Clinical rehabilitation, 28(1), 82-90.
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ANNEXURE 4

GROSS MOTOR FUNCTION MEASURE (GMFM)
SCORE SHEET (GMFM-88 and GMFM-66 scoring)

Child's Name: _____ ID#: _____

Assessment Date: _____ (year / month / day)

GMFCS Level[1]: ☐ I ☐ II ☐ III ☐ IV ☐ V

Date of Birth: _____ (year / month / day)

Chronological Age: _____ (year / month / day)

Evaluator's Name: _____

Testing Condition (e.g., room, clothing, time, others present):

_____

The GMFM is a standardized observational instrument designed and validated to measure change in gross motor function over time in children with cerebral palsy. The scoring key is meant to be a general guideline. However, most of the items have specific descriptors for each score. It is imperative that the guidelines contained in the manual be used for scoring each item.

SCORING KEY

0 = does not initiate
1 = initiates
2 = partially completes
3 = completes
9 (or leave blank) = not tested (NT) [used for the GMAE-2 scoring*]

It is important to differentiate a true score of "0" (child does not initiate) from an item which is Not Tested (NT) if you are interested in using the GMFM-66 Ability Estimator (GMAE) Software.

*The GMAE-2 software is available for downloading from www.canchild.ca for those who have purchased the GMFM manual. The GMFM-66 is only valid for use with children who have cerebral palsy.

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CanChild Centre for Childhood Disability Research

[1]GMFCS level is a rating of severity of motor function. Definitions for the GMFCS-E&R (expanded & revised) are found in Palisano et al. (2008). Developmental Medicine & Child Neurology. 50:744-750 and in the GMAE-2 scoring software. http://motorgrowth.canchild.ca/en/GMFCS/resources/GMFCS-ER.pdf

Check (3) the appropriate score: if an item is not tested (NT), circle the item number on the right column

Item		A: LYING & ROLLING	SCORE				NT
	1.	SUP, HEAD IN MIDLINE: TURNS HEAD WITH EXTREMITIES SYMMETRICAL	0☐	1☐	2☐	3☐	1.
*	2.	SUP: BRINGS HANDS TO MIDLINE, FINGERS ONE WITH THE OTHER	0☐	1☐	2☐	3☐	2.
	3.	SUP: LIFTS HEAD 45°	0☐	1☐	2☐	3☐	3.
	4.	SUP: FLEXES R HIP & KNEE THROUGH FULL RANGE	0☐	1☐	2☐	3☐	4.
	5.	SUP: FLEXES L HIP & KNEE THROUGH FULL RANGE	0☐	1☐	2☐	3☐	5.
*	6.	SUP: REACHES OUT WITH R ARM, HAND CROSSES MIDLINE TOWARD TOY	0☐	1☐	2☐	3☐	6.
*	7.	SUP: REACHES OUT WITH L ARM, HAND CROSSES MIDLINE TOWARD TOY	0☐	1☐	2☐	3☐	7.
	8.	SUP: ROLLS TO PR OVER R SIDE	0☐	1☐	2☐	3☐	8.
	9.	SUP: ROLLS TO PR OVER L SIDE	0☐	1☐	2☐	3☐	9.
*	10.	PR: LIFTS HEAD UPRIGHT	0☐	1☐	2☐	3☐	10.
	11.	PR ON FOREARMS: LIFTS HEAD UPRIGHT, ELBOWS EXT., CHEST RAISED	0☐	1☐	2☐	3☐	11.
	12.	PR ON FOREARMS: WEIGHT ON R FOREARM, FULLY EXTENDS OPPOSITE ARM FORWARD	0☐	1☐	2☐	3☐	12.
	13.	PR ON FOREARMS: WEIGHT ON L FOREARM, FULLY EXTENDS OPPOSITE ARM FORWARD	0☐	1☐	2☐	3☐	13.
	14.	PR: ROLLS TO SUP OVER R SIDE	0☐	1☐	2☐	3☐	14.
	15.	PR: ROLLS TO SUP OVER L SIDE	0☐	1☐	2☐	3☐	15.
	16.	PR: PIVOTS TO R 90° USING EXTREMITIES	0☐	1☐	2☐	3☐	16.
	17.	PR: PIVOTS TO L 90° USING EXTREMITIES	0☐	1☐	2☐	3☐	17.
		TOTAL DIMENSION A					

Item		B: SITTING	SCORE				NT
*	18.	SUP, HANDS GRASPED BY EXAMINER: PULLS SELF TO SITTING WITH HEAD CONTROL	0☐	1☐	2☐	3☐	18.
	19.	SUP: ROLLS TO R SIDE, ATTAINS SITTING	0☐	1☐	2☐	3☐	19.
	20.	SUP: ROLLS TO L SIDE, ATTAINS SITTING	0☐	1☐	2☐	3☐	20.
*	21.	SIT ON MAT, SUPPORTED AT THORAX BY THERAPIST: LIFTS HEAD UPRIGHT, MAINTAINS 3 SECONDS	0☐	1☐	2☐	3☐	21.
*	22.	SIT ON MAT, SUPPORTED AT THORAX BY THERAPIST: LIFTS HEAD MIDLINE, MAINTAINS 10 SECONDS	0☐	1☐	2☐	3☐	22.
*	23.	SIT ON MAT, ARM(S) PROPPING: MAINTAINS, 5 SECONDS	0☐	1☐	2☐	3☐	23.
*	24.	SIT ON MAT: MAINTAIN, ARMS FREE, 3 SECONDS	0☐	1☐	2☐	3☐	24.
*	25.	SIT ON MAT WITH SMALL TOY IN FRONT: LEANS FORWARD, TOUCHESTOY, RE-ERECTS WITHOUT ARM PROPPING	0☐	1☐	2☐	3☐	25.
*	26.	SIT ON MAT: TOUCHES TOY PLACED 45° BEHIND CHILD'S R SIDE, RETURNS TO START	0☐	1☐	2☐	3☐	26.
*	27.	SIT ON MAT: TOUCHES TOY PLACED 45° BEHIND CHILD'S L SIDE, RETURNS TO START	0☐	1☐	2☐	3☐	27.
	28.	R SIDE SIT: MAINTAINS, ARMS FREE, 5 SECONDS	0☐	1☐	2☐	3☐	28.
	29.	L SIDE SIT: MAINTAINS, ARMS FREE, 5 SECONDS	0☐	1☐	2☐	3☐	29.
*	30.	SIT ON MAT: LOWERS TO PR WITH CONTROL	0☐	1☐	2☐	3☐	30.
*	31.	SIT ON MAT WITH FEET IN FRONT: ATTAINS 4 POINT OVER R SIDE	0☐	1☐	2☐	3☐	31.
*	32.	SIT ON MAT WITH FEET IN FRONT: ATTAINS 4 POINT OVER L SIDE	0☐	1☐	2☐	3☐	32.
	33.	SIT ON MAT: PIVOTS 90°, WITHOUT ARMS ASSISTING	0☐	1☐	2☐	3☐	33.
*	34.	SIT ON BENCH: MAINTAINS, ARMS AND FEET FREE, 10 SECONDS	0☐	1☐	2☐	3☐	34.
*	35.	STD: ATTAINS SIT ON SMALL BENCH	0☐	1☐	2☐	3☐	35.
*	36.	ON THE FLOOR: ATTAINS SIT ON SMALL BENCH	0☐	1☐	2☐	3☐	36.
*	37.	ON THE FLOOR: ATTAINS SIT ON LARGE BENCH	0☐	1☐	2☐	3☐	37.
		TOTAL DIMENSION B					

Item	C: CRAWLING & KNEELING	SCORE				NT
38.	PR: CREEPS FORWARD 1.8m (6')	0☐	1☐	2☐	3☐	38.
* 39.	4 POINT: MAINTAINS, WEIGHT ON HANDS AND KNEES, 10 SECONDS	0☐	1☐	2☐	3☐	39.
* 40.	4 POINT: ATTAINS SIT ARMS FREE	0☐	1☐	2☐	3☐	40.
* 41.	PR: ATTAINS 4 POINT, WEIGHT ON HANDS AND KNEES	0☐	1☐	2☐	3☐	41.
* 42.	4 POINT: REACHES FORWARD WITH R ARM, HAND ABOVE SHOULDER LEVEL	0☐	1☐	2☐	3☐	42.
* 43.	4 POINT: REACHES FORWARD WITH L ARM, HAND ABOVE SHOULDER LEVEL	0☐	1☐	2☐	3☐	43.
* 44.	4 POINT: CRAWLS OR HITCHES FORWARD 1.8m(6')	0☐	1☐	2☐	3☐	44.
* 45.	4 POINT: CRAWLS RECIPROCALLY FORWARD1.8m (6')	0☐	1☐	2☐	3☐	45.
* 46.	4 POINT: CRAWLS UP 4 STEPS ON HANDS AND KNEES/FEET	0☐	1☐	2☐	3☐	46.
47.	4 POINT: CRAWLS BACKWARDS DOWN 4 STEPS ON HANDS AND KNEES/FEET	0☐	1☐	2☐	3☐	47.
* 48.	SIT ON MAT: ATTAINS HIGH KN USING ARMS, MAINTAINS, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	48.
49.	HIGH KN: ATTAINS HALF KN ON R KNEE USING ARMS, MAINTAINS, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	49.
50.	HIGH KN: ATTAINS HALF KN ON L KNEE USING ARMS, MAINTAINS, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	50.
* 51.	HIGH KN: KN WALKS FORWARD 10 STEPS, ARMS FREE	0☐	1☐	2☐	3☐	51.

TOTAL DIMENSION C ☐

Item	D: STANDING	SCORE				NT
* 52.	ON THE FLOOR: PULLS TO STD AT LARGE BENCH	0☐	1☐	2☐	3☐	52.
* 53.	STD: MAINTAINS, ARMS FREE, 3 SECONDS	0☐	1☐	2☐	3☐	53.
* 54.	STD: HOLDING ON TO LARGE BENCH WITH ONE HAND, LIFTS R FOOT, 3 SECONDS	0☐	1☐	2☐	3☐	54.
* 55.	STD: HOLDING ON TO LARGE BENCH WITH ONE HAND, LIFTS L FOOT, 3 SECONDS	0☐	1☐	2☐	3☐	55.
* 56.	STD: MAINTAINS, ARMS FREE, 20 SECONDS	0☐	1☐	2☐	3☐	56.
* 57.	STD: LIFTS L FOOT, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	57.
* 58.	STD: LIFTS R FOOT, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	58.
* 59.	SIT ON SMALL BENCH: ATTAINS STD WITHOUT USING ARMS	0☐	1☐	2☐	3☐	59.
* 60.	HIGH KN: ATTAINS STD THROUGH HALF KN ON R KNEE, WITHOUT USING ARMS	0☐	1☐	2☐	3☐	60.
* 61.	HIGH KN: ATTAINS STD THROUGH HALF KN ON L KNEE, WITHOUT USING ARMS	0☐	1☐	2☐	3☐	61.
* 62.	STD: LOWERS TO SIT ON FLOOR WITH CONTROL, ARMS FREE	0☐	1☐	2☐	3☐	62.
* 63.	STD: ATTAINS SQUAT, ARMS FREE	0☐	1☐	2☐	3☐	63.
* 64.	STD: PICKS UP OBJECT FROM FLOOR, ARMS FREE, RETURNS TO STAND	0☐	1☐	2☐	3☐	64.

TOTAL DIMENSION D ☐

Item		E: WALKING, RUNNING & JUMPING	SCORE				NT
*	65.	STD, 2 HANDS ON LARGE BENCH: CRUISES 5 STEPS TO R	0☐	1☐	2☐	3☐	65.
*	66.	STD, 2 HANDS ON LARGE BENCH: CRUISES 5 STEPS TO L	0☐	1☐	2☐	3☐	66.
*	67.	STD, 2 HANDS HELD: WALKS FORWARD 10 STEPS	0☐	1☐	2☐	3☐	67.
*	68.	STD, 1 HAND HELD: WALKS FORWARD 10 STEPS	0☐	1☐	2☐	3☐	68.
*	69.	STD: WALKS FORWARD 10 STEPS	0☐	1☐	2☐	3☐	69.
*	70.	STD: WALKS FORWARD 10 STEPS, STOPS, TURNS 180°, RETURNS	0☐	1☐	2☐	3☐	70.
*	71.	STD: WALKS BACKWARD 10 STEPS	0☐	1☐	2☐	3☐	71.
*	72.	STD: WALKS FORWARD 10 STEPS, CARRYING A LARGE OBJECT WITH 2 HANDS	0☐	1☐	2☐	3☐	72.
*	73.	STD: WALKS FORWARD 10 CONSECUTIVE STEPS BETWEEN PARALLEL LINES 20cm (8")APART	0☐	1☐	2☐	3☐	73.
*	74.	STD: WALKS FORWARD 10 CONSECUTIVE STEPS ON A STRAIGHT LINE 2cm (3/4") WIDE	0☐	1☐	2☐	3☐	74.
*	75.	STD: STEPS OVER STICK AT KNEE LEVEL, R FOOT LEADING	0☐	1☐	2☐	3☐	75.
*	76.	STD: STEPS OVER STICK AT KNEE LEVEL, L FOOT LEADING	0☐	1☐	2☐	3☐	76.
*	77.	STD: RUNS 4.5m (15'), STOPS & RETURNS	0☐	1☐	2☐	3☐	77.
*	78.	STD: KICKS BALL WITH R FOOT	0☐	1☐	2☐	3☐	78.
*	79.	STD: KICKS BALL WITH L FOOT	0☐	1☐	2☐	3☐	79.
*	80.	STD: JUMPS 30cm (12") HIGH, BOTH FEET SIMULTANEOUSLY	0☐	1☐	2☐	3☐	80.
*	81.	STD: JUMPS FORWARD 30 cm (12"), BOTH FEET SIMULTANEOUSLY	0☐	1☐	2☐	3☐	81.
*	82.	STD ON R FOOT: HOPS ON R FOOT 10 TIMES WITHIN A 60cm (24") CIRCLE	0☐	1☐	2☐	3☐	82.
*	83.	STD ON L FOOT: HOPS ON L FOOT 10 TIMES WITHIN A 60cm (24") CIRCLE	0☐	1☐	2☐	3☐	83.
*	84.	STD, HOLDING 1 RAIL: WALKS UP 4 STEPS, HOLDING 1 RAIL, ALTERNATING FEET	0☐	1☐	2☐	3☐	84.
*	85.	STD, HOLDING 1 RAIL: WALKS DOWN 4 STEPS, HOLDING 1 RAIL, ALTERNATING FEET	0☐	1☐	2☐	3☐	85.
*	86.	STD: WALKS UP 4 STEPS, ALTERNATING FEET	0☐	1☐	2☐	3☐	86.
*	87.	STD: WALKS DOWN 4 STEPS, ALTERNATING FEET	0☐	1☐	2☐	3☐	87.
*	88.	STD ON 15cm (6") STEP: JUMPS OFF, BOTH FEET SIMULTANEOUSLY	0☐	1☐	2☐	3☐	88.

TOTAL DIMENSION E ☐

Was this assessment indicative of this child's "regular" performance? YES ☐ NO ☐

COMMENTS:

GMFM-88 SUMMARY SCORE

DIMENSION	CALCULATION OF DIMENSION % SCORES	GOAL AREA (indicated with ✓ check)
A. Lying & Rolling	$\frac{\text{Total Dimension A}}{51} = \frac{\quad}{51} \times 100 = \quad\%$	A. ☐
B. Sitting	$\frac{\text{Total Dimension B}}{60} = \frac{\quad}{60} \times 100 = \quad\%$	B. ☐
C. Crawling & Kneeling	$\frac{\text{Total Dimension C}}{42} = \frac{\quad}{42} \times 100 = \quad\%$	C. ☐
D. Standing	$\frac{\text{Total Dimension D}}{39} = \frac{\quad}{39} \times 100 = \quad\%$	D. ☐
E. Walking, Running & Jumping	$\frac{\text{Total Dimension E}}{72} = \frac{\quad}{72} \times 100 = \quad\%$	E. ☐

TOTAL SCORE = $\frac{\%A + \%B + \%C + \%D + \%E}{\text{Total \# of Dimensions}}$

$= \frac{\quad}{5} = \quad = \quad\%$

GOAL TOTAL SCORE = $\frac{\text{Sum of \%scores for each dimension identified as a goal area}}{\text{\# of Goal areas}}$

$= \quad = \quad\%$

GMFM-66 Gross Motor Ability Estimator Score [1]

GMFM-66 Score = _____ _____ to _____
95% Confidence Intervals

previous GMFM-66 Score = _____ _____ to _____
95% Confidence Intervals

change in GMFM-66 = _____

[1] from the Gross Motor Ability Estimator (GMAE-2) Software

TESTING WITH AIDS/ORTHOSES USING THE GMFM-88

Indicate below with a check (4) which aid/orthosis was used and what dimension it was first applied. (There may be more than one).

AID	Dimension	Orthosis	Dimension
Rollator/pusher ☐	___	Hip Control ☐	___
Walker ☐	___	Knee Control ☐	___
H Frame crutches ☐	___	Ankle-foot Control ☐	___
Crutches ☐	___	Foot Control ☐	___
Quad Cane ☐	___	Shoes ☐	___
Cane ☐	___	None ☐	___
None ☐	___	Other ☐	___
Other ☐ ___ (please specify)		___ (please specify)	

GMFM-88 SUMMARY SCORE USING AIDS/ORTHOSES

DIMENSION	CALCULATION OF DIMENSION % SCORES	GOAL AREA (indicated with ✓ check)
F. Lying & Rolling	$\frac{\text{Total Dimension A}}{51} = \frac{\quad}{51} \times 100 = \quad\%$	A. ☐
G. Sitting	$\frac{\text{Total Dimension B}}{60} = \frac{\quad}{60} \times 100 = \quad\%$	B. ☐
H. Crawling & Kneeling	$\frac{\text{Total Dimension C}}{42} = \frac{\quad}{42} \times 100 = \quad\%$	C. ☐
I. Standing	$\frac{\text{Total Dimension D}}{39} = \frac{\quad}{39} \times 100 = \quad\%$	D. ☐
J. Walking, Running & Jumping	$\frac{\text{Total Dimension E}}{72} = \frac{\quad}{72} \times 100 = \quad\%$	E. ☐

TOTAL SCORE = $\frac{\%A + \%B + \%C + \%D + \%E}{\text{Total \# of Dimensions}}$

$= \frac{\quad}{5} = \quad = \quad\%$

GOAL TOTAL SCORE = $\frac{\text{Sum of \%scores for each dimension identified as a goal area}}{\text{\# of Goal areas}}$

$= \quad = \quad\%$

