



Improvement In Balance And Reduction Of Fall Risk In A Case Diagnosed With Duchenne Muscular Dystrophy: A Case Report

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Abstract:

Background: Duchenne Muscular Dystrophy (DMD) is a progressive neuromuscular disorder characterized by muscle weakness, impaired balance, and an increased risk of falls. Early physiotherapy interventions can play a crucial role in maintaining function and reducing fall risk.

Case Description: An 8-year-old male child with DMD presented with frequent falls and difficulty performing daily activities such as stair climbing. He exhibited typical signs, including anterior pelvic tilt, waddling gait, and proximal lower limb weakness. The outcome measures used were the Paediatric Balance Scale (PBS) and the Paediatric Functional Reach Test (P-FRT).

Intervention: The child received a structured physiotherapy program over two months (four sessions per week) focusing on balance training, lower limb strengthening, stretching, and functional mobility exercises.

Outcomes: Post-intervention assessments showed improvement in balance with PBS increasing from 16/56 to 33/56 and P-FRT reach distance improving from 7 cm to 19 cm. The child demonstrated enhanced postural control and reduced fall frequency.

Conclusion: Early and consistent physiotherapy interventions can significantly improve balance and reduce fall risk in children with DMD, enhancing functional independence and quality of life.

Key Words: DMD, Balance, Fall Risk, Physiotherapy rehabilitation, trampoline

I. INTRODUCTION

Duchenne Muscular Dystrophy (DMD) is a progressive X-linked recessive neuromuscular disorder caused by mutations in the dystrophin gene, leading to degeneration and weakness of skeletal muscles, particularly those of the pelvic girdle and proximal lower limbs. ⁽¹⁾ The disease commonly manifests in early childhood, typically between the ages of 2 to 5 years, with symptoms such as delayed motor milestones, frequent falls, and difficulty in climbing stairs or rising from the floor. ⁽²⁾

As DMD progresses, the gradual weakening of trunk and lower limb musculature results in significant balance impairments, altered posture, and compensatory gait patterns such as waddling gait and anterior pelvic tilt. ⁽³⁾ These impairments not only reduce functional independence but also increase the risk of falls, which can lead to secondary complications, fear of movement, and decreased participation in physical activities. ⁽⁴⁾

The assessment of balance and functional mobility in children with DMD is essential for planning physiotherapy interventions and monitoring disease progression. The Pediatric Balance Scale (PBS) has been widely used for evaluating static and dynamic balance abilities in children with neuromuscular disorders. ⁽⁵⁾ Additionally, the Pediatric Functional Reach Test (P-FRT) is a reliable, simple, and sensitive

tool that assesses a child's limit of stability in the forward direction, providing insight into dynamic postural control and fall risk. ^{(6),(7)}

Early physiotherapy intervention, focusing on balance training, core strengthening, and functional mobility, is effective in reducing fall risk and improving overall motor function in children with DMD [8]. This case report presents an 8-year-old boy diagnosed with Duchenne Muscular Dystrophy, with a focus on assessing and improving balance and reducing the risk of falls using outcome measures like PBS and P-FRT.

1. CASE DESCRIPTION

History

The present case involves an 8-year-old male child, JKN, who was brought in with complaints of frequent falls for the past year and increasing difficulty in performing age-appropriate activities of daily living, such as stair climbing and toileting. The child is the second offspring of non-consanguineous parents. The developmental history revealed delayed gross motor milestones, although the immunization history is complete.

The patient belongs to an upper-middle-class family. The father is a police constable and the mother is also police constable. There is no history of similar illness in the family. Perinatal and postnatal histories are largely uneventful, except for a brief NICU stay of 5 days due to neonatal jaundice. There was no exposure to radiation, drug abuse, or maternal illness during pregnancy.

The child's speech development was within normal limits, with monosyllables and bisyllables achieved by 6 and 9 months, respectively. Currently, the child is on steroid medication (Tab. Defcort, GM6) and nutritional supplements to maintain muscle strength and delay disease progression.

GENERAL AND NEUROLOGICAL EXAMINATION

On general examination, the child weighed 18 kg and had a height of 114 cm with a head circumference of 49.5 cm. His posture showed an anterior pelvic tilt, shoulder depression, and a widened base of support. Vitals were stable (SpO₂: 98%, PR: 88 bpm). On observation, the child had difficulty standing unsupported and presented with a waddling gait.

Neurological examination showed intact higher mental functions, including attention, concentration, memory, and orientation to time, place, and person. Speech and cranial nerves were intact. Reflexes were diminished on the left side across all deep tendon reflexes, while superficial reflexes were present. Sensory examination was intact. Muscle tone was normal.

MOTOR AND BALANCE ASSESSMENT

Motor examination showed weakness predominantly in the lower limbs. Manual Muscle Testing (MMT) revealed reduced muscle strength graded between 2+ and 3- in the hip and knee joints. Passive range of motion (ROM) of the upper limb was within normal limits, whereas lower limb ROM showed mild restrictions in hip and ankle joints. There was also tightness noted in the Tendo Achilles, hamstrings, and adductors.

Abdominal muscle strength was poor (Grade 1), and trunk extension was also weak. Balance assessment revealed impairments in both static and dynamic balance.

GAIT ASSESSMENT

Gait evaluation revealed the following parameters: Stride length: 59 cm (normal: 69–112 cm), Step length: 34 cm (normal: 33–39 cm), Base width: 14 cm (normal: 5–10 cm), Cadence: 105 steps/min. The child demonstrated a waddling gait pattern characterized by hip abductor weakness, excessive plantarflexion due to dorsiflexor weakness, and anterior pelvic tilt due to gluteus maximus weakness and tight hip flexors.

OUTCOME MEASURES

Paediatric Balance Scale: Score of 16/56 indicating a high fall risk. And in the Paediatric functional reach test, reach distance average was 7cm, i.e., severe balance impairment.

2. PROCEDURE

Ethical approval from the Institutional Ethical Committee was not needed, and the patient's mother gave an informed written consent. His demographic data, physical examination, pre- and post-Paediatric balance scale, and the Paediatric functional reach test were recorded. From 3rd March to 4th May 2025, physiotherapy treatment was given, approximately 4 sessions/week for 2 months.

Intervention program: - Mild stretching for lower limb (hamstring, Tendo Achillies, Hip adductors, Piriformis) 10 seconds of 5 repetitions. Upper and lower limb active movement is given 10 times, for lower limb strengthening- ball kicking activity was given, Pelvic bridges for 10 times, modified abdominal curls for 10 times, and wobble board for 2 minutes. Single leg stand for alternate leg for 10 repetition each was given.

Sit to stand in parallel bar for 10 times, feet together with eyes closed for 5 times with 10 seconds. Treadmill for 3 minutes, trampoline for 2 minutes, stair climbing up and down for 5 stairs for 2 times, spirometer for 20 times was given.



Fig. 1 & 2 - Modified Abdominal curls



Fig. 3- Hamstring stretch, Fig. 4 – Hip Adductor stretch



Fig. 5 – Trampoline jumping, Fig. 6 – Incentive Spirometer

Follow-up Assessment

The paediatric balance scale and the Paediatric functional reach test scores were increased. Score for Paediatric balance scale is 33/56, indicating moderate fall risk, and for Paediatric functional reach test, reach distance average is 19 cm, i.e. Mild balance impairment.

3. DISCUSSION

Duchenne Muscular Dystrophy (DMD) is characterized by progressive muscle weakness, especially in the proximal lower limbs, leading to impaired balance, gait abnormalities, and increased fall risk. In this case, the 8-year-old child presented with classical signs of DMD, including frequent falls, waddling gait, anterior pelvic tilt, and muscle weakness, particularly affecting the lower limbs.

Balance impairments in children with DMD result from a combination of muscle weakness, joint contractures, and compensatory movement patterns. This not only affects their mobility but also limits their ability to participate in daily activities, thereby reducing their quality of life. Studies have shown that early physiotherapy interventions focusing on balance, strength, and functional mobility can slow down the deterioration of motor abilities and reduce fall risk in DMD patients.^{(3) (4)}

In this case, physiotherapy interventions included lower limb stretching, strengthening exercises, core stability training, dynamic balance activities, and functional mobility exercises such as stair climbing and treadmill walking. These interventions were designed to address muscle tightness, improve joint mobility, enhance postural control, and promote functional independence.

The outcome measures used—Paediatric Balance Scale (PBS) and Paediatric Functional Reach Test (P-FRT)—were appropriate and sensitive in capturing the improvements in balance and fall risk. The child's PBS score improved from 16/56 (high fall risk) to 33/56 (moderate fall risk), and the P-FRT reach distance increased from 7 cm to 19 cm, indicating improved dynamic postural control. These findings are consistent with previous research demonstrating the benefits of physiotherapy in improving balance and functional mobility in children with neuromuscular disorders.^{(5) (6)}

The case highlights the importance of individualized, early, and consistent physiotherapy intervention in managing the progressive nature of DMD. While the condition remains incurable, physiotherapy plays a crucial role in preserving mobility, reducing fall risk, and enhancing the child's participation in daily life.

4. CONCLUSION

This case study demonstrates that a structured physiotherapy program focusing on balance training, lower limb strengthening, core stability, and functional mobility significantly improved balance and reduced fall risk in an 8-year-old child with Duchenne Muscular Dystrophy. Early and consistent rehabilitation interventions can positively impact functional outcomes and quality of life, even in progressive neuromuscular disorders like DMD. Regular assessment using reliable outcome measures such as the Paediatric Balance Scale and Paediatric Functional Reach Test is essential for monitoring progress and guiding therapeutic strategies.

5. STUDY LIMITATION

1. Single Case Study Design: The findings are based on one individual and therefore cannot be generalized to the broader DMD population without caution.

2. Short Follow-up Duration: The intervention period was limited to two months, which may not be sufficient to capture long-term effects or disease progression.

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