International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

Physiotherapy Management of Limbgirdle Muscular Dystrophy with Associated Flatfoot in a Young Adult Female: A Case Report

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Abstract: ***Introduction**: A 20-year-old female patient with LGMD presents with Gowers' sign, difficulty in sit to stand, Fatigue and difficulties descending stairs. Unilateral flatfoot further changed lower-limb biomechanics, resulting in poor gait, decreased balance, and more functional restrictions. This highlights the necessity for Physiotherapy that addresses both foot alignment and muscle weakness. A four-week multimodal physiotherapy program was tailored to address proximal weakness along with Foot flat. Outcome measures taken were Berg Balance Scale, North Star Ambulatory Assessment and Dynamic Gait Index. Structural foot changes were monitored via the Foot Posture Index and Navicular Drop Test, while systemic impact was measured through the Fatigue Severity Scale and PROMIS-29 profile. Outcome measures were assessed pre and post Treatment. **Results**: Increased Berg Balance Scale, Dynamic Gait Index, and North Star Ambulatory Assessment scores showed significant improvements in balance, gait, and functional mobility following sessions. Significant improvement in the Navicular Drop Test, Foot Posture Index, fatigue Severity Scale, and PROMIS-29 scores indicated improvements in foot posture and arch support, as well as decreased fatigue and improved health-related quality of life. **Conclusion**: A four-week multimodal physiotherapy treatment that included unilateral flatfoot correction with proximal strengthening enhanced biomechanical alignment, postural stability, and functional independence.*

Keywords: Limb-girdle Muscular Dystrophy, Flatfoot, Growers sign, Shoe modification, Physiotherapy

1. Introduction

The term "limb-girdle muscular dystrophy" (LGMD) describes a broad range of muscle disorders characterized by proximal limb-girdle weakening. LGMD is a group of progressive, rare, inherited, and medically diverse neuromuscular disorders. [1] One characteristic that distinguishes LGMD is the weakening in the muscles that affects the shoulder and pelvic girdles. [2] It is a group of genetic disorders that progressively weaken skeletal muscle, resulting in physical disabilities and muscular weakening. [3] Genetic defects in limb-girdle muscular dystrophy cause certain proteins needed for skeletal muscle development and function to break down. Calpain-3 (CAPN3) alleles in an autosomal recessive inheritance must be faulty. A mutation in the calpain-3 gene causes a deficiency of the CAPN3 protein, which is essential for muscle cell activity. A deficiency of CAPN3 causes aberrant proteins to build up in muscle cells, which causes gradual weakening and atrophy of the muscles.[4] The estimated prevalence of LGMD worldwide is one in 14,500–45,000.[5] LGMD is characterized by symmetrical muscular atrophy and weakening, particularly in the shoulder and pelvic girdle muscles. Due to the disease's progressive weakening of the muscles and impairment of their capacity to function, people with LGMD2A can exhibit Gower's sign, which is described as difficulty rising up from a sitting or reclining posture without the assistance of hands. [6,7]

Depending on the degree of muscular weakness, patients may have dyspnea either at rest or when exercising. There is this indication of diaphragmatic weakening, which may be a characteristic that distinguishes LGMD2A. [8] In order to support, maintain, and improve quality of life, physiotherapy and rehabilitation become even more crucial when there are no ways to prevent the diseases from getting worse.[9]The goal of exercise treatment for individuals with LGMD is to preserve joint mobility, muscular strength, and functional activity level for as long as possible.[10]

A musculoskeletal condition known as "flatfoot" causes the foot's medial longitudinal arch (MLA) to flatten or drop. It can be attributed to a complicated combination of both dynamic and static problems. This condition is linked to a number of risk factors, including musculoskeletal problems, foot injuries, and increased weight. [11] Persistent collapse of the medial longitudinal arch and limited foot movement are the hallmarks of rigid flatfoot, which impairs balance and modifies gait mechanics. Stretching, balance training, tibialis posterior strengthening, intrinsic foot muscle strengthening, and orthotic support are examples of physiotherapy exercises that can enhance foot alignment, stability, and overall functional performance. [12,13]

2. Case Report

A 20-year-old female patient with Limb-Girdle Muscular Dystrophy (LGMD) presented with progressive bilateral lower-limb weakness, left side flatfoot, difficulty in walking, difficulty in ascending stairs, and difficulty performing sit-to-stand transfers. She had a history of digestive problems throughout infancy, involving considerable medical care,

and she was delivered at full term. In 2019, she had a liver transplant after several medical consultations. Her parents noticed the gradual onset of paralysis in both lower limbs following the procedure. Her functional abilities deteriorated over time, making her more dependent on assistance for walking and standing. She was assessed by a neurologist, who suggested additional investigation and medical care because there was no noticeable improvement. LGMD was diagnosed after being sent to a higher institution. In order to address her muscular weakness, gait problems, balance issues, and decreased functional independence, she was recommended physiotherapy rehabilitation in 2024.

3. Clinical Findings

The patient was afebrile on general examination, with a heart rate of 84 beats/min, a blood pressure of 116/80 mm Hg, and a respiratory rate of 15 breaths/min. A neurological examination revealed that cranial nerves, speech, and cognitive function were all intact. Her sensory system was intact. She presented with weakness in bilateral Hips. Tone was normal in all the four limbs. Table.1 presents the results of manual muscle testing (MMT), which was a strength measure for the patient.

Table 1: Strength ratings (manual muscle testing) by Medical Research Council grading

Muscle	Pre rehabilitation Right side	Pre rehabilitation Left side	Post Rehabilitation Right side	Post Rehabilitation Left side
Hip flexors	2/5	2/5	3/5	3/5
Hip extensors	2/5	2/5	3/5	3/5
Hip Abductors	3/5	3/5	4/5	4/5
Hip Adductors	3/5	3/5	4/5	4/5
Knee flexors	4/5	4/5	5/5	5/5
Knee extensors	4/5	4/5	5/5	5/5
Ankle Dorsiflexors	3/5	3/5	4/5	4/5
Ankle Plantarflexors	3/5	3/5	4/5	4/5

2: Complete range of motion with gravity eliminated; 3: complete range of motion in opposition to gravity; 4: complete range of motion with minimum resistance against gravity; 5: complete range of motion with maximum resistance against gravity

Tightness was present in Bilateral tibialis anterior and Hamstring muscles. Gower's signs was positive and all deep tendon reflexes and superficial reflexes were intact. She demonstrated a waddling gait pattern. Bilateral Foot assessment was done by performing the wet foot test to assess the Flatfoot. This revealed a rigid flatfoot on left side. Patient also complained of fatigue during activities and stair climbing. The MRI both spine and brain , NCV, RNS reports were normal. Muscular dystrophy was discovered through a genetic testing and also based on elevated ESR and CK levels.

Table 2: The laboratory values in the complete blood count report

	Patients observed value	Normal values
ESR	22 mm/hr.	0-20 mm/hr.
CK	241U/L	30-135 U/L

ESR: erythrocyte sedimentation rate; CK: creatinine kinase; mm/hr.: millimeters per hour; U/L: units per liter.

Outcome measures

Outcome measures were used to comprehensively assess the patient's balance, gait, foot posture, fatigue, functional mobility, and quality of life. The Berg Balance Scale (BBS) was used to assess functional balance. The Foot Posture Index (FPI) and Navicular Drop Test (NDT) were used to evaluate foot posture and the degree of flatfoot. The North Star Ambulatory Assessment (NSAA) and Dynamic Gait Index (DGI) were used to quantify functional mobility and ambulatory capability. The Fatigue Severity Scale (FSS) was used to measure fatigue levels, and the Patient-Reported Outcomes Measurement Information System-29 (PROMIS-29) was used to measure health-related quality of life.

Table 3: Outcome measure scores Pre & Post Treatment

Outcome Measures	Pre Rehabilitation	Post Rehabilitation (4 Weeks)
Berg Balance scale	44/56	53/56
North star ambulatory Assessment	24/34	31/34
Dynamic Gait Index	21/24	23/24
Foot Posture Index	+8	+6
Navicular Drop Test	10mm	8mm
Fatigue Severity scale	30/63	15/63
PROMIS-29	Physical function: 8/20; anxiety: 12/20; depression: 8/20; fatigue: 16/20; sleep disturbance: 10/20; ability to perform activity: 14/20; pain interference: 4/20 pain intensity: 0/10	Physical function: 5/20; anxiety: 9/20; depression: 6/20; fatigue: 10/20; sleep disturbance: 4/20; ability to perform activity: 8/20; pain interference: 0/20 pain intensity: 0/10

Physiotherapy Intervention

A comprehensive four-week physiotherapy rehabilitation program (described in Table no.4) was developed to treat the patient's unilateral flatfoot and Limb-Girdle Muscular Dystrophy weakness. The goal of the intervention was to reduce fatigue and avoid secondary problems while

enhancing muscular strength, flexibility, balance, gait, endurance, and functional mobility. Stretching, strengthening, gait and balance training, task-specific functional activities, neurodevelopmental methods, foot-specific exercises, and endurance training were all used. In order to improve postural stability, optimize lower-limb biomechanics, increase mobility, and promote independence in daily living activities, the program was gradually modified based on the patient's tolerance and functional performance.

Table 4: Four-Week Multimodal Physiotherapy Rehabilitation Program

Goals	Treatment Strategy	Intervention (Weeks 1-2)	Progression (Weeks 3-4)
Patient Education	Educate the patient and her family members about patient's condition.	Patient and Family educated regarding LGMD, prognosis, energy conservation techniques and Rehabilitation goals.	A home exercise program was Demonstrated and Reinforcement of home exercise program, self-monitoring of fatigue and functional status.
Reduce Muscle Tightness	Stretching Exercises	Hamstrings, Tibialis Anterior and Gracilis, Adductor Magnus, Adductor Longus, Pectineus Stretching (3-5 repetitions with 30 sec hold)	Continued stretching with emphasis on proper technique and maintenance of muscle length
To improve muscle strength and ROM	Mobility and strengthening exercises	Active- assisted ROM exercises for Hip flexion, extension, abduction and Adduction; Static Hamstrings and Static Quadriceps (10 repetitions, 10-second hold); Core Strengthening exercise with Pressure Biofeedback (10 repetitions, 5-second hold).	Low-to-moderate intensity bilateral lower-limb strengthening using 0.5–1 kg weight cuffs as tolerated; progression of core stabilization exercises with biofeedback.
Improve Balance and gait Training	Balance and Gait Training	Single-leg standing with support, wobble board training, spot marching, obstacle walking, and treadmill gait training	Progression from supported to supervised unsupported single-leg stance; treadmill gait training with light distal loading (1 kg weight cuff) as tolerated.
To improve Stair Descending	Strengthening exercise NMES	NMES(Quadriceps) + Step Up & Down with support Partial Squats with railing support	Stair ascent and descent with minimal or no support; progression to independent partial squats.
Improve Kneeling to Half kneeling transition	Neurodevelopmental Treatment (NDT)	Kneeling to half kneeling transitions using stool support	Kneeling to half kneeling using swiss ball for dynamic stability
Correct Flatfoot and Improve Foot Mechanics	Footwear modification and intrinsic foot muscle strengthening	Shoe modification short foot exercise, Tibialis posterior strengthening with yellow Theraband +Iliopsoas stretching + Towel curls	Progression of tibialis posterior strengthening using red TheraBand while continuing short-foot exercises, stretching, and towel curls.
Improve endurance	Endurance Training	Low-intensity arm ergometry and cycling with monitoring of fatigue.	Arm ergometry and cycling with gradual resistance progression according to tolerance.
Maintain Respiratory Function	Respiratory muscle training	Diaphragmatic breathing, thoracic expansion exercises, and breathing control techniques.	Progression to inspiratory muscle training and increased repetitions as tolerated.
Improve Functional Independence	Task-specific functional training	Sit-to-stand practice, transfer training, and gait-related functional activities.	Progression to independent sit-to-stand, floor-to-stand transitions, and community mobility tasks.

4. Discussion

This case study highlights how a four-week multimodal physiotherapy rehabilitation program could enhance functional results for a young adult girl with unilateral flatfoot and limb-girdle muscular dystrophy (LGMD). Muscle strength, balance, gait performance, functional mobility, foot posture, fatigue, and quality of life all showed improvements post intervention.

Nandanwar et al. found substantial gains in ambulation and functional independence in a patient with LGMD after undergoing a systematic physiotherapy rehabilitation programme. Similar results were reported in the current case study, where muscular strength and North Star Ambulatory Assessment scores improved following targeted strengthening and functional training. [3]

The combination of obstacle training, treadmill walking, balance training, and task-specific functional activities may be responsible for the improvement in balance and gait performance, as demonstrated by improved Berg Balance Scale and Dynamic Gait Index scores. In his case study, Nandanwar et al. showed how an organized physiotherapy rehabilitation program improved a person with LGMD's functional mobility and independence. Similarly, Voet emphasized in the review study that people with neuromuscular problems enhanced their functional ability, mobility, and physical performance with adequately prescribed exercises. These results are in line with the improvements in functional mobility, balance, and gait performance shown in the current study following an intensive physiotherapy rehabilitation program. [3,14]

Additionally, the patient had a unilateral flatfoot, which might have affected the stability and gait mechanics. By increasing intrinsic foot muscle activation, Huang et al. showed that short-foot exercises greatly enhance foot posture and medial longitudinal arch support. Elsayed et al. revealed that foot alignment and functional performance improved more when foot-specific exercises were combined with orthotic support than when training was used alone. The current study demonstrated improvements in Foot Posture Index and Navicular Drop Test scores after shoe

modification and intrinsic foot muscle strengthening, which is consistent with these findings. [12,13]

One of the most prevalent and signs of impairment that people with muscle dystrophies encounter is fatigue. According to a research by Kalkman et al., fatigue has a major impact on both daily activities and participation in physical activity. The current study showed a significant decrease in Fatigue Severity Scale ratings after rehabilitation, which is consistent with these findings. Improved muscle efficiency, increased endurance, improved gait mechanics, and the use of energy-saving techniques in the physiotherapy program might all be responsible for this improvement. Improved functional performance and more participation in routine activities were probably caused by the decrease in fatigue. [15]

Additionally, improvements in physical function, fatigue, anxiety, and depression were shown by PROMIS-29 scores. These results suggest that physiotherapy may have a favourable impact on psychological well-being and overall quality of life in addition to improving physical performance. All of the study's findings highlight the importance of tailored physiotherapy treatments for maximizing functional independence and treating neuromuscular and biomechanical abnormalities in LGMD patients.

5. Conclusion

This Case study demonstrates the potential advantages of a comprehensive physical therapy rehabilitation program for a young adult with unilateral flatfoot and limb-girdle muscular dystrophy. Muscle strength, balance, gait performance, functional mobility, foot posture, and fatigue levels all improved after four weeks of intervention, improving overall quality of life. Proximal muscle strengthening, balance and gait training, endurance exercises, and foot-specific corrective therapies seemed to improve biomechanical alignment and postural stability. Despite the fact that LGMD is a degenerative neuromuscular condition, tailored rehabilitation can be crucial in enhancing involvement in daily activities, minimizing activity limits, and optimizing functional independence. The long-term effects of focused physiotherapy therapies in people with LGMD need more research.

Declaration by Authors

Ethical Approval: Approved

Acknowledgement:
I would like to extend my deepest gratitude to the management of Pravara Institute of Medical Sciences for permitting me to carry out this project in the institution. I wish to express my deep gratitude to my project In-charge **Dr. Komal Gunjal (PT)** and all teaching staff who have helped me to choose the project and provided me with constant guidance and support throughout the completion of this project.

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

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