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EFFECT OF LOW INTENSITY INTERVAL BASED EXERCISE PROGRAMME PERFORMED DURING THE DRUG ON WINDOW ON FUNCTIONAL ENDURANCE, FATIGUE AND QUALITY OF LIFE IN MYASTHENIA GRAVIS: A CASE REPORT

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ABSTRACT

BACKGROUND

Myasthenia gravis (MG) is an autoimmune neuromuscular disorder characterized by Fluctuating muscle weakness and fatiguability, which significantly impair functional Performance. Exercise prescription in MG remains challenging due to fear of symptoms Exacerbation. However, performing exercise during the pharmacological “on window “ Of anticholinesterase medication may optimize neuromuscular performance and reduce

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Fatigue. This case report explores the effect of a low intensity interval- based exercise Program performed during the window period on functional performance and fatigue in a Patient with MG.

OBJECTIVES:

This case report aims to describe the effectiveness of goal Oriented physiotherapy intervention in improving the functional endurance, fatigue levels and quality of life in a patient diagnosed with Myasthenia Gravis.

METHODS

A patient diagnosed with generalized myasthenia gravis underwent a structured low Intensity interval - based exercise program during the peak therapeutic window of Pyridostigmine. Exercise sessions were initiated approximately 45 – 60 minutes post Medication. Resistance training was done using TheraBand based on the patients 10 – repetition maximum (10 RM). Upper and lower limb exercises were performed Using yellow TheraBand (light resistance = 1.3 kg at 100 % elongation) initially and Progressed to red TheraBand (moderate resistance = 1.7 kg at 100% elongation) as tolerated. The protocol followed an interval format with short bouts of activity interspersed with adequate rest to prevent excessive fatigue. Out come measures include the SIX MINUTE WALK TEST (6MWT) to assess **functional performance (endurance)**, FATIGUE IMPACT SCALE (FIS) to assess the perceived **fatigue** and MG-ADL SCALE for the **quality of life** of patient.

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RESULTS

Following the physiotherapy intervention, the patient demonstrated gradual improvement in functional endurance, fatigue levels and quality of life. Increased patient functional endurance levels and improved quality of life with decreased fatigue levels were observed during reassessment which indicates positive functional restoration.

CONCLUSION

This case report highlights that a carefully monitored low intensity interval – based exercise programme, when performed during the pharmacological window of pyridostigmine, can improve functional performance, quality of life and reduce fatigue levels in patient with MG. The timed exercise with medication effectiveness, combined with individualized low resistance interval training, may allow safe and effective rehabilitation in MG without symptom worsening.

KEYWORDS

Myasthenia Gravis (MG), drug on window, TheraBand, Low intensity, 10RM, functional endurance, fatigue, quality of life.

INTRODUCTION

Myasthenia gravis (MG) is a chronic autoimmune neuromuscular disorder characterized by fluctuating skeletal muscle weakness and increased fatiguability caused by pathogenic autoantibodies targeting components of the postsynaptic neuromuscular junction. functional deficits often manifest as limb weakness, impaired respiratory function and reduced exercise tolerance, which collectively compromise daily activities and quality of life. Physical inactivity secondary to MG symptoms may further exacerbate functional decline [1,2]. Symptomatic pharmacological treatment for MG primarily involves acetylcholinesterase inhibitors such as

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pyridostigmine, which enhance synaptic acetylcholine availability and transiently improve neuromuscular transmission. pyridostigmine's onset of action occurs within 15- 30 minutes of ingestion, with peak effect typically observed at approximately 45 minutes and duration of benefit lasting upto several hours, thus creating a predictable period of enhanced muscle strength often referred to as the "drug on window "[3,4]. Leveraging this window period for targeted therapeutic interventions may optimize functional outcomes while minimizing fatigue related limitations, yet clinical application in exercise prescription remains underexplored. In MG, exercise training has been approaching with caution due to concerns that physical exertion could exacerbate fatigability or provoke clinical deterioration [5]. Systematic, individually tailored exercise programs are safe for patients with mild to moderate MG and can produce meaningful improvements in muscle strength, physical performance and functional capacity without disease worsening [6-8]. Despite this growing evidence, a clinical gap remains: few studies have strategically aligned exercise interventions with the PharmoKinetic profile of acetylcholinesterase inhibitors, particularly by targeting the so - called drug on window – the post dose period during which patient experience peak symptomatic benefit and optimal neuromuscular transmission. Timing exercise to coincide with greater strength, reduced fatiguability and better overall functional responses.

CASE DESCRIPTION

A 42 year old male patient, daily wager by occupation, presented to the department of neurology on 08/01/2025 with complaints of easily early onset fatigue during walking and stair climbing, difficulty performing sustained upper limb activities such as lifting objects and overhead tasks, generalized muscle weakness – weakness worsening towards the end of the day and occasional double vision to lateral gaze with left eyelid ptosis on sustained gaze for the past two months. He denies any swallowing, speech or respiratory difficulties.

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On diagnostic evaluation, he had positive for serum AChR antibodies and significant decremental response on repetitive nerve stimulation (RNS) > 10%. Routine blood investigations were within normal limits, no evidence of thymoma on CT scan and normal sensory and motor conduction velocities on nerve conduction studies.

Then he was diagnosed as Genaralized Myasthenia Gravis and prescribed to use anticholinesterase medication (pyridostigmine 60 mg, 3 times per day) along with corticosteroids (prednisone 25mg). There was no history of diabetes, hypertension, thyroid related or any other diseases.

CLINICAL FINDINGS ON EXAMINAATION

Timing of assessment

All assessments were conducted during the drug trough phase (drug weak effect) avoid false diagnosis and consistency of results.

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Clinical examination	Findings
General physical examination	The patient was Alert, oriented and cooperative (GCS 15/ 15) with no cognitive defects (MMSE 30/ 30). Resting vital signs were within normal limits. no signs of respiratory distress were observed at rest. speech was clear, and facial symmetry was maintained. posture in sitting and standing was upright, with no head drop or trunk instability.
Sensory examination:	All sensations were in intact without any sensory abnormalities.
Cranial nerve examination:	Cranial nerve examination was performed to evaluate any ocular, facial and bulbar involvement. All cranial nerves were in intact.
Muscle tone:	Tone was found to be normal throughout in both upper limbs and lower limbs, with no tightness.
Deep tendon reflexes:	Reflexes were symmetrical, brisk and within normal limits

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Manual muscle testing (MMT):	Muscle strength was assessed initially and repeated following fatiguing activity because fatigable weakness is the hallmark symptom of MG. Following repetition, fatigability in the form of weakness was observed.
Functional assessment:	**Bed mobility:** Independent **Sit to stand, transfers:** Independent, but with reduced speed on fatigue **Ambulation**: Independent on level surface with reduced endurance on prolonged activity greater than 10 min **Stair climbing**: Independent with rest pauses **Overhead activities:** Normal but limited amplitude on fatigue **BARTHEL INDEX SCALE**: 90/ 100 (functionally independent)

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Balance and coordination:	Static and dynamic balance were assessed by using BBS and found to be normal within functional limits. But mild difficulty was observed in doing dynamic balance following fatigue. Coordination testing was normal. **BBS score:** 52/56 (no risk of fall) Severity of disease was assessed by using MGC scale **MGC score** 12/50
On diagnostic evaluation	He had positive for serum AChR antibodies and significant decremental response on repetitive nerve stimulation **(RNS)** > 10%, Routine blood investigations were within normal limits, no evidence of thymoma on CT scan and normal sensory and motor conduction velocities on nerve conduction studies.

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FATIGUE INDUCED BED SIDE TESTS: To assess the ocular, bulbar and axial muscle involvement;

Sustained upward gaze test: ptosis developed after approximately 50 sec

Repetitive arm abduction test: progressive reduction in movement amplitude and strength was noted after 8-10 repetitions

Sustained head lift: Gradually head drops backwards after 50sec

Outstretched arm / leg test: Gradual decline with initial position (Drift) Seen after approximately 50sec

Peek sign test: Positive

Single breath count test: Clear voice with no nasal speech

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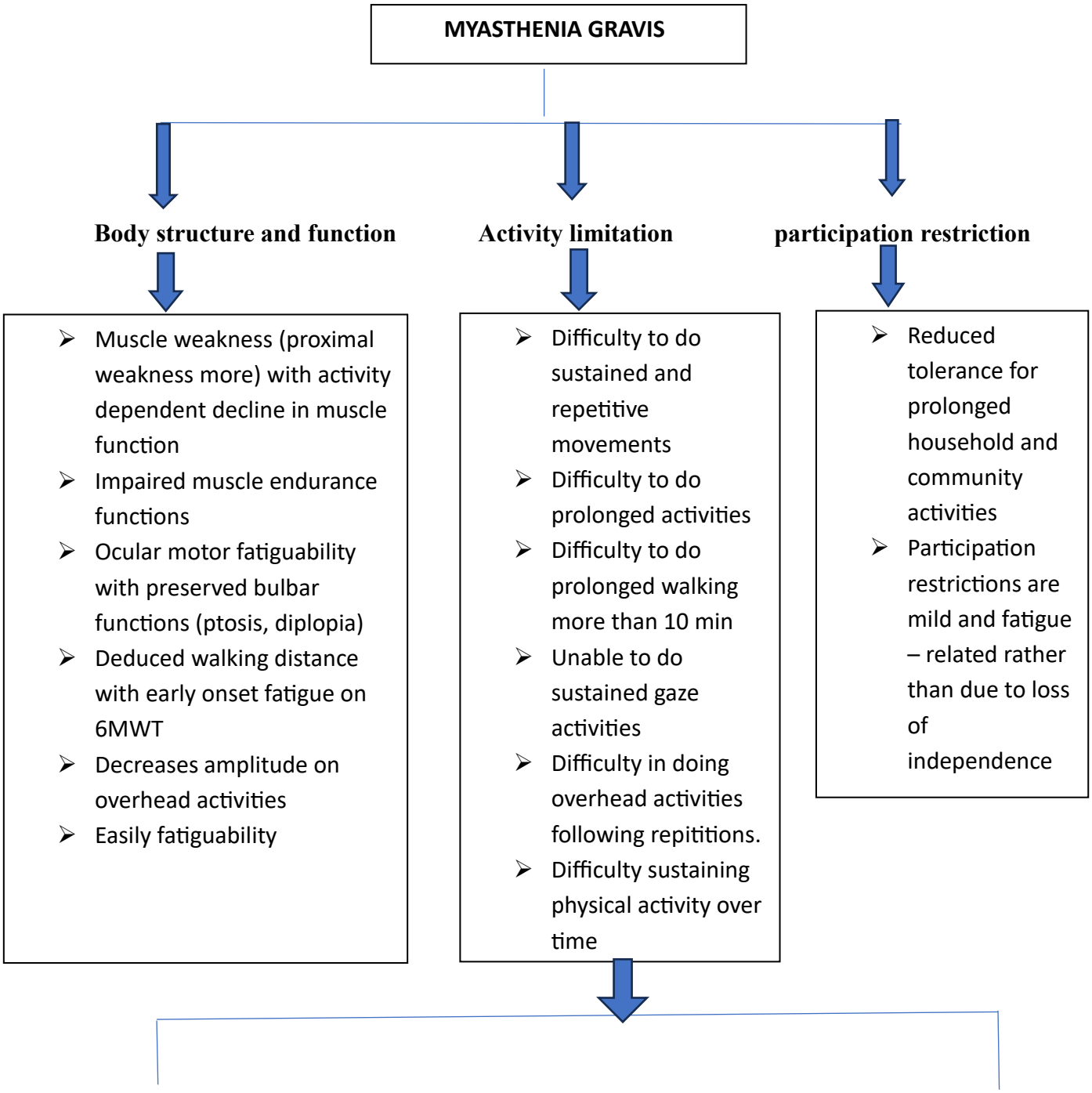
ICF CLASSIFICATION



Environmental factors	**personal factors**
Facilitators: medication timing, supporting family,	Adult patient(42yr)
Planned activitieswith proper rest breaks,	Male
Motivated to participate in rehabilitation **Barriers:** fatigue with sustained activity	Cognitively intact

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PHYSSIOTHERAPY INTERVENTION:

Exercise was scheduled during the “drug on window”, defined as 45- 60 minutes after administration of anticholinesterase medication, when neuromuscular transmission is optimal. This timing helps reduce fatiguability, improve endurance and enhance functional performance in patients with MG.

EXERCISE PROTOCOL:

A low intensity interval Based exercise program was administered using TheraBand resistance, tailored individual. Resistance was determined by calculating 10 Repetition Maximum (RM) separately for each major muscle group of upper and lower limbs.

EXERCISE PRESCRIPTION:

Frequency:

5 days /week for 4 weeks

Intensity: Low intensity

Repetitions and sets:

8- 10 repetitions per set

2-3 sets for muscle group

Work – rest ratio: 1: 2

Progression:

Gradual increase in repetitions before resistance

Close monitor of fatigue using Borg RPE scale

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OUTCOME MEASURES

Following outcome measure were used to quantify functional endurance, fatigue levels and quality of life.

Outcome measure	Pre value	Post value
6MWT	360 Meters	420 Meters
Fatigue impact scale (FIS)	78/ 160	52/160
MG- ADL scale	8/24	5/24

DISCUSSION

This case report clinically relevant and addressed the physiotherapy approach in the management of generalized myasthenia gravis (MG) by implementing a low – intensity interval Based resistance exercise program timed within the anticholinesterase drug on window. Although exercise is increasingly recognized as safe in stable MG, the integration of pharmacological timing with structured interval resistance training remains under reported, making this case valuable

Usually, exercises have been prescribed with more cautious in MG due to concerns regarding exacerbation of fatiguability and neuromuscular transmission failure. However, recent studies have demonstrated that low – moderate intensity aerobic and resistance training can improve functional capacity, muscle strength and quality of life without worsening symptom in patients

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with mild to moderate MG (9-11). Despite these findings, most existing studies lack standardized exercise prescription, often failing to define resistance based on objective measures such as repetition maximum and work rest ratios. Furthermore, exercise timing relative to anticholinesterase medication, a critical factor in MG due to fluctuating neuromuscular transmission, has rarely been addressed (12). In contrast, this case specifically utilized the drug- on window (45 - 60 minutes post pyridostigmine) to optimize neuromuscular efficiency.

The use of individualized 10 RM – based TheraBand resistance, combined with 1:2 work – rest ratio, provided a controlled and reproducible framework that aligns with current recommendations to avoid over fatigue in MG (10,13).

This case addresses important gaps in the literature by demonstrating that timing exercise with peak medication efficacy, along with low intensity interval resistance training may enhance outcomes in MG rehabilitation. However, as a single case report, the findings cannot be generalized. Larger controlled studies are required to establish standardized guidelines regarding exercise intensity, progression, and optimal drug – exercise timing in MG.

CONCLUSION

This case report explaining low intensity interval Based exercise program performed during the drug on its peak effects show improvements in functional endurance, fatigue levels and quality of life in patients with MG. The clinically meaningful improvements in 6 Minute Walk Test Distance, fatigue impact scale and MG- ADL scores further support the feasibility of this approach.

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