

Use of JOGO EMG Biofeedback in Post OP Laminectomy L2-L3 With Cauda Equina Syndrome in Improving Gait and Dynamic Balance

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ABSTRACT

Decompression via lumbar laminectomy is a common treatment for Cauda Equina Syndrome but may lead to musculoskeletal complications. We present a case of post-laminectomy instability and functional issues, demonstrating significant improvement with EMG biofeedback. Case Report: A 62-year-old male with a history of chronic low back pain underwent L2-L3 vertebrae decompression for Cauda Equina Syndrome. Post-surgery, he experienced imbalance, difficulty in voluntary dorsiflexion and muscle weakness. JOGO EMG biofeedback therapy, combined with various rehabilitation interventions, resulted in notable improvements in functional independence, Asia Impairment Scale, manual muscle testing, Berg Balance Scale and EMG amplitude. Conclusion: JOGO EMG biofeedback therapy, providing real-time feedback, effectively enhanced muscle activation, particularly in the tibialis anterior. This intervention significantly improved the patient's muscle activity, functional abilities, gait, and dynamic balance.

BACKGROUND

- Cauda Equina Syndrome (CES) is typically characterized by severe lower back pain, bilateral sciatica, sexual dysfunction, and bilateral leg pain and weakness.¹⁻³
- CES, although rare, holds a significant medico-legal profile and is often associated with substantial lower lumbar disc issues, such as herniation, prolapse, or sequestration and spinal stenosis.^{1,2}
- The surgical interventions as standard of care for CES typically involve laminectomy with instrumentation/fusion for stabilization or discectomy are recommended.⁴⁻⁶
- Nerve damage can be one of the major risk of a laminectomy which may cause disability/malfunction in lower or upper limbs.^{7,8}
- Wang et al. showed that electromyographic (EMG) biofeedback (BF) therapy intervention can improve limb function in stroke patients.⁹
- A recent study on healthy volunteers also demonstrated that EMG-BF has potential for a more effective rehabilitation system, particularly emphasizing the positive impact of ankle plantar flexor muscle BF on walking stability in both anteroposterior and vertical directions.¹⁰
- Thus, we present a case with instability and functional difficulties post-laminectomy in patient with Cauda Equina Syndrome, which showed significant improvement with EMG-BF.

CASE DESCRIPTION

A 62-age old male who was working in Saudi as a four-wheeler driver with history of chronic low back pain for the past 2 year. He had a minor fall at his work due to pain and weakness in his bilateral lower limbs muscles and was admitted in hospital on June 2022 and diagnosed as severe CES June 2022. Post-operative recovery was uneventful and the patient shifted to India to his home for further care. Started consulting neurologist at Chennai, India and referred to JOGO for further treatment. Examination and history of present illness mentioned in Table 1.

Table 1. Physical Examination

Chief Complaints	Clinical Observations
Not able to do stand independently, in walker support	Body Build: Endomorphic body type, weight 102 kg, height 178cm, BMI 32.2
Not able to do sit to stand need one person support	Neck: Forward neck posture, rounded shoulders, genu varum, and a slightly inverted left foot alignment
Difficulties in daily activities such as restroom visits, walking inside house, climbing stairs etc.	Gait: Imbalance during standing and walking. Altered gait pattern evident, attributed to weakness in both lower limbs. Absence of heel strike noted in the left foot. Inability to voluntarily dorsiflex the ankles (foot drop).
Fear of fall while attempting to walk with support	Coordination: Normal Sensation: Intact Bowel and bladder: Normal

INITIAL EVALUATION

All parameters for initial evaluation [Functional Independence Measure (FIM), Manual Muscle Testing (MMT), Berg Balance Scale (BBS), and Asia Impairment Scale (AIS)] are mentioned in Table 2.

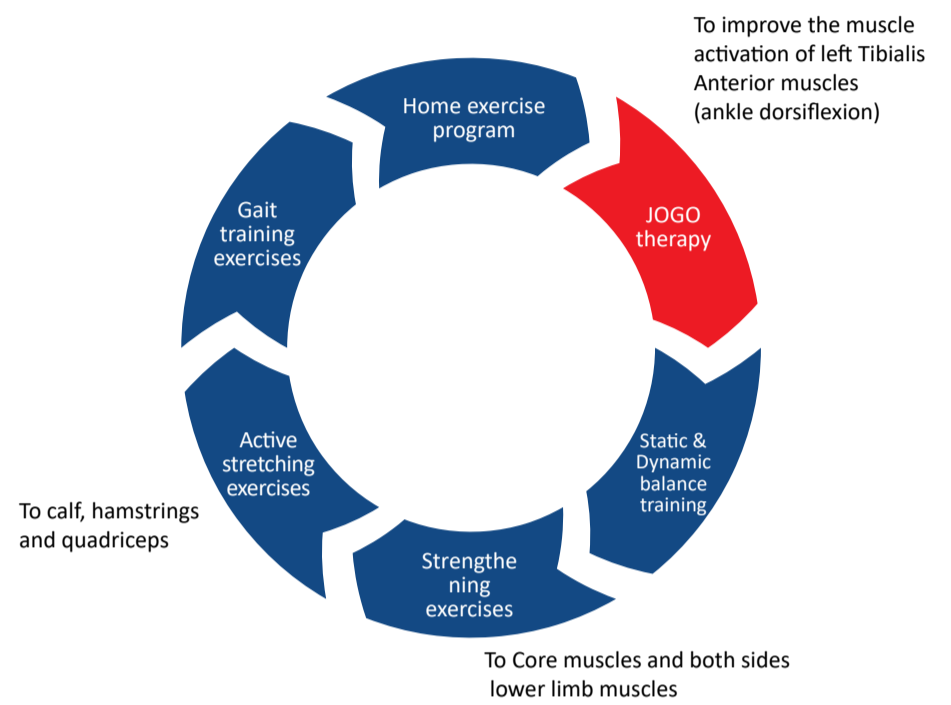
METHODOLOGY

Total 12 treatment sessions (4 weeks thrice a week) - JOGO therapy is given for first 30 minutes in all 12 sessions for improving the muscle activation of Bilateral Tibialis anterior muscle and the next 30 minutes for static and dynamic balance & Gait training and Coordination & Strengthening exercises. Treatment goals mentioned in table 3. Tibialis anterior was chosen because : (1) the patient's initial gait lacked heel strike and he walked with reduced base of support, insufficient loading during midstance. This increases the risk of fall. (2) It is a distal muscle. Increase in the amplitude of Tibialis anterior reflects an increased proximal joint stability which is important for balance.

Table 3. Treatment Goals

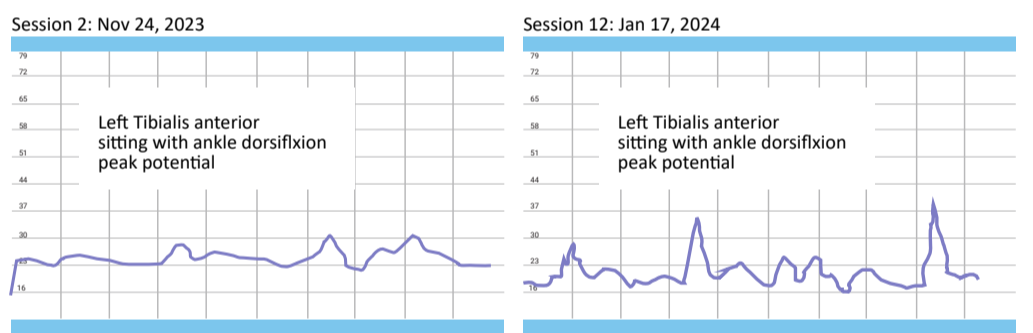
Short Term Goals	Long Term Goals
To make him to do active dorsiflexion in his left ankle within 12 sessions	To improve his muscle strength in bilateral lower limb muscles
To make him to walk without the use of tripod for his daily activities, within 12 sessions	To improve his dynamic balance
	To boost confidence for achieving financial independence through work

INTERVENTION TECHNIQUES



OUTCOMES

Initially JOGO BF assessment was taken in left Tibialis anterior. Range : 5-12 mvS
JOGO BF training was given in left Tibialis anterior. Range : 5-23 mvS



After 12 sessions of JOGO therapy intervention, patient can walk without the walker or tripod support, able to do all his routine activities independently and now planned to start working to become financially independent (Table 2).

Table 2. Pre and Post JOGO Therapy Outcomes Summary

	Pre - JOGO Therapy (Nov 24, 2023)	Post - JOGO Therapy (Jan 17, 2024)
Patient Responses	Unable to do daily activities) Pain and swelling in left ankle region	Able to perform daily activities Independent in all ADL No pain and swelling
Outcome Measures (FIM)	37/63	57/63
AIS	Grade B: Sensory function preserved, but not motorfunction (flicker) below the injury level	Grade C: Motor function preserved, but over 50% of key muscles below neurological level have a muscle grade <3.
MMT (Lower limb)	Left – 1/5; Right – 2/5	Left – 2/5; Right – 3/5
BBS	14/56	37/56
JOGO peak potential	Amplitude of Tibialis Anterior Blue (left) 7 (5-12mvS)	Amplitude of Tibialis Anterior blue (left) are 18 (5-23mvS)

CONCLUSIONS

- JOGO EMG BF therapy provided real-time feedback on muscle activity, which in turn facilitated the activation of tibialis anterior muscle
- There was increase in the patient's muscle activity and his ability to perform basic activities improved
- His gait and dynamic balance also improved significantly

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