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CASE REPORT

Effects of chronic baclofen use on active movement in an individual with a spinal cord injury

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Study design: Case report.
Objectives: To describe a case of chronic use of oral baclofen in a patient with spinal cord injury limiting lower extremity movements.
Setting: Frazier Rehab Institute, Louisville, Kentucky and University of Louisville.
Report: A 24-year-old male with a C5 AIS-B spinal cord injury received a neurophysiological examination pre and post cessation of the use of oral baclofen. The initial results revealed no motor activity below the level of the lesion during reinforcement maneuvers or active movements. Following discontinuance of baclofen, motor activity was detected in upper and lower extremity muscles during some tasks. Locomotor patterns during stepping on a treadmill with body weight support did not reveal excessive overactivity of the lower extremity muscles. The patient was also able to perform squats independently at 35–40% body weight support when standing on a treadmill.
Conclusion: Baclofen is typically prescribed for the management of spasticity in individuals with spinal cord injury. The interaction of reduced spasticity on functional tasks is not well understood, raising an important limitation of neurological exams and classifications done under heavy dosages of medication.
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Keywords: spinal cord injury; baclofen; locomotion

INTRODUCTION

Seventy percent of patients with spinal cord injury (SCI) are prescribed medications for the treatment of spasticity.[1] Baclofen, a gamma-aminobutyric acid receptor$_B$ agonist, is the most commonly used medication to control spasticity in the SCI population.[1] Long-term use of baclofen has been shown to weaken muscle strength and increase fatigue,[2] however the interaction of reduced spasticity on functional tasks is poorly understood.[3,4]

CASE REPORT

A 24-year-old male, 33 months post SCI with a classification of C5 AIS-B,[5] underwent a series of physiological tests. Initial evaluation revealed limited use of upper extremities and no volitional movement in lower extremities. Patient exhibited a 1–2 rating on the modified Ashworth scale. Clonus was 3–9 beats on both gastrocnemius and left soleus, and sustained on right. Reflexes were hyper-responsive bilaterally for the patellar tendon and normal bilaterally on the Achilles tendon.

At the time of first assessment, the patient was taking 20 mg of oral baclofen, 2 mg of Valium and 2 mg of Zanaflex daily. On physician's recommendation, the patient completed a 26-day weaning schedule (Baclofen: 14 days; Valium: 6 days; Zanaflex: 6 days).

RESULTS

A functional neurophysiological assessment was performed on the patient before the initiation of the weaning schedule. Reinforcement maneuvers are used in the assessment to identify potential motor connections that are not apparent during voluntary tasks. No activation of the lower extremity muscles was present during neck flexion with resistance (Figure 1a). Activity of the upper trapezius and biceps brachii were present and considered compensatory for this reinforcement task. The same assessment was repeated with the patient off all medications (Figure 1b). Electromyographic (EMG) activity was present on the same muscles, as well as other upper extremity muscles tested. Lower extremity activity of the tibialis anterior, extensor digitorum longus and soleus were also seen following the release of the resistance. The functional neurophysiological assessment also includes a series of active and passive voluntary movements ranging from hip to toe. When asked to perform left-side plantarflexion with knee extended, motor activity was seen only after discontinuing all medications (Figure 2). The initial evaluation showed no activity of upper or lower extremity muscles during the same task and no ability to move lower extremities. Following the completion of the weaning schedule, bilateral activity was seen in upper extremity muscles and left-side lower extremity muscles. The tibialis anterior and extensor digitorum longus were both active during plantarflexion. The patient reported being able to move his toes voluntarily approximately 2 weeks following the initiation of the prescribed schedule. No activity was seen in any other voluntary tasks left or right post medication withdrawal. A follow-up ASIA examination revealed an improvement in classification to AIS-C.

The patient had received 32 locomotor training sessions before the initial evaluation and an additional 14 sessions throughout

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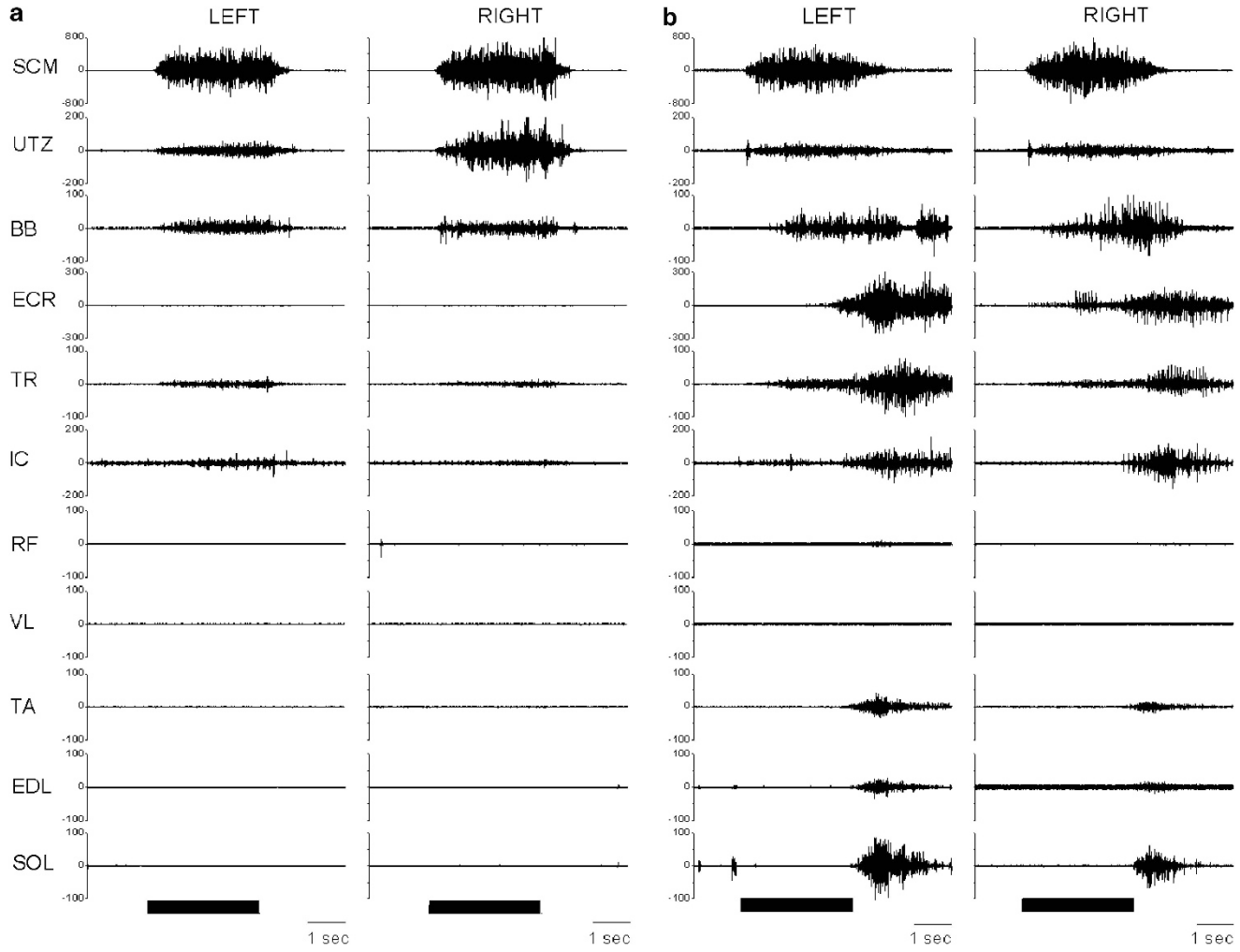

Figure 1 Bilateral EMG activity during reinforcement maneuver. Bilateral EMG activity during neck flexion against resistance (**a**) pre withdrawal from medication and (**b**) post withdrawal from medication. Muscles: sternocleidomastoid (SCM), upper trappezius (UTZ), biceps brachii (BB), extensor carpiradialis (ECR), triceps brachii (TR), intercostal (IC), rectus femoris (RF), vastus lateralis (VL), tibialis anterior (TA), extensor digitorum longus (EDL), soleus (SOL). EMG scale (μV). The black bar represents the duration of neck flexion.

his weaning period. A locomotor training evaluation with lower extremity EMG was performed on the patient following withdrawal from anti-spasticity medication (Figure 3). A range of treadmill speeds and body weight support were used to arrive at the optimal speed and load. During stepping, the left ankle muscles showed more activity than the right. Ankle dorsiflexors were co-active with plantarflexos during stance. The hamstrings were active during swing. The EMG activation patterns did not show excessive overactivity during the gait cycle that would interfere with stepping.

DISCUSSION

Prescription of baclofen and other anti-spasticity medication is a prevalent practice in the medical management of SCI individuals.[1] Chronic use of such medication is typical, however very little is known about the long-term needs for spasticity control. Here we present a case of voluntary control regained 33 months after injury following the discontinued used of anti-spasticity medications. To our knowledge, this is the first reported case in which following a prescribed cessation from medication the patient is able to voluntarily move his toes, stand and squat independently with body weight support and also improve AIS classifications. Initially, the patient was examined while on daily anti-spasticity medications. At examination and throughout his previous medical history, he was classified as AIS-B. A functional neurophysiological assessment also revealed no motor activity in the lower extremities during reinforcement maneuvers and active joint movements.

Following the initial management of the injury, all subsequent neurological examinations are performed while individuals are medicated. This practice presents a limitation as neurological exams require the individual to perform or respond to certain tasks. Anti-spasticity medications will mask the true potential of the motor component of the examination, as it was seen in this case report. Evidence is also presented in this case that discontinuing the use of baclofen will not interfere with the ability to demonstrate oscillatory step-like motor patterns during functional tasks such as stepping with body weight support.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

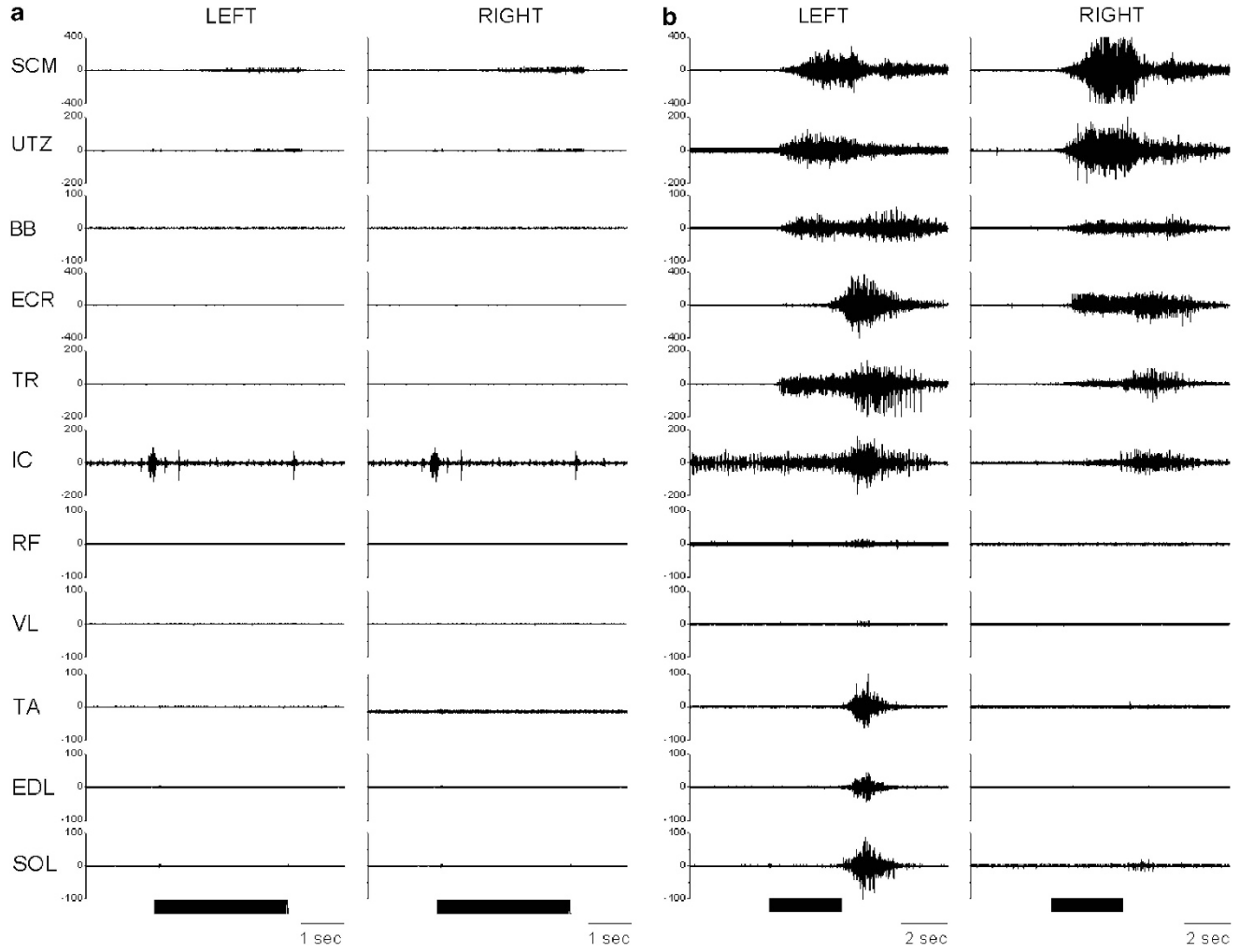

Figure 2 Bilateral EMG activity during left ankle plantarflexion. Bilateral EMG activity during active left ankle plantarflexion with knee extended (**a**) pre withdrawal from medication and (**b**) post withdrawal from medication. Muscles: sternocleidomastoid (SCM), upper trappezius (UTZ), biceps brachii (BB), extensor carpiradialis (ECR), triceps brachii (TR), intercostal (IC), rectus femoris (RF), vastus lateralis (VL), tibialis anterior (TA), extensor digitorum longus (EDL), soleus (SOL). EMG scale (μV). The black bar represents the active ankle plantarflexion based on a command to 'plantarflex now'.

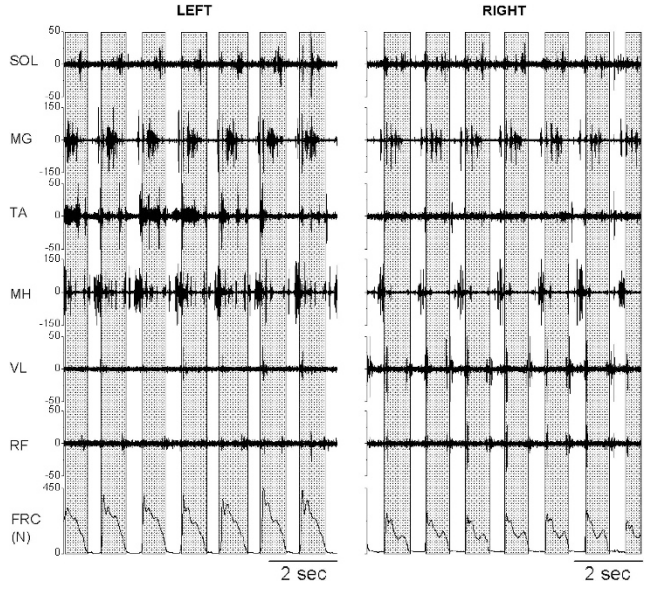

Figure 3 Bilateral EMG activity during stepping with body weight support on a treadmill. Bilateral EMG activity during stepping with manual facilitation at 1.07 m s^{-1} and 55% body weight load. Patient was not taking any anti-spasticity medications. FRC is the vertical reaction force during each step in Newtons (N). Gray shading represents the stance phase of each step. Muscles: soleus (SOL), medial gastrocnemius (MG), tibialis anterior (TA), medial hamstrings (MH), vastus lateralis (VL), rectus femoris (RF). EMG scale (μV).

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