

## CASE REPORT

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## FUNCTIONAL ELECTRICAL STIMULATION FOR FOOT DYSTONIA: A CASE REPORT

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## ABSTRACT

**Background:** Functional Electrical Stimulation (FES) can be used as an alternative to ankle foot orthosis (AFO) for foot drop following upper motor neuron lesions. A few patients with stroke might experience dystonia as part of its symptomatology. Dystonia can appear at presentation of the stroke or they may be delayed. Post stroke dystonia can affect either one side of the body (hemidystonia) or can be segmental or focal.

**Method:** A 20 year old male, known case of post stroke right foot dystonia was put on Functional Electrical Stimulation (FES) for walking. The ODFS pace device was used for stimulating his right evertors and dorsiflexors while walking. He was made to practice walking with the help of FES for 30 minutes every day, 6 days a week for 4 weeks. The outcome measures were 10 meter walk test, Berg Balance Score (BBS) and ankle range of motion.

**Result:** Despite using the FES, patient continued to experience the same gait difficulty i.e. twisting of right leg while walking although he reports having gained confidence while walking.

**Conclusion:** FES could be used as a novel symptomatic treatment for the abnormal contractions present during dystonia. There, however, is limited data for the role of FES in treating dystonia.

**Keywords:** Functional Electrical Stimulation, FES, Stroke, Dystonia, Foot Dystonia

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## INTRODUCTION

Functional Electrical Stimulation (FES) is an intervention designed to improve walking by producing contractions in the paralysed muscles by the application of small pulses of electrical stimulation to the intact nerve that supplies the paralysed muscle.<sup>1,2</sup> FES for lower limb works by electrically stimulating the common peroneal nerve during the swing phase of gait leading to contraction of the tibialis anterior muscle and lateral compartment muscles with resultant dorsiflexion and eversion of the foot. FES can be used as an alternative to ankle foot orthosis (AFO) for central foot drop<sup>3</sup>.

Dystonia, which is defined as involuntary sustained muscle contraction frequently causing twisting and repetitive movements or abnormal posturing, can manifest as part of the symptomatology of acute stroke. Dystonia can appear at presentation of the stroke or they may be delayed.<sup>4,5</sup> The frequency of post stroke involuntary movements is unclear. In a study of 1500 patients with stroke 56 developed movement disorders up to one year after the stroke. Patients with chorea were older and people with dystonia were younger.<sup>6</sup> Many different locations within the brain have been identified as areas that are responsible for abnormal movements. The basal ganglia are most often involved in post stroke movement disorder.<sup>7,8</sup> Post stroke dystonia can involve either one side of the body (hemidystonia) or can be segmental or focal. Focal dystonia can affect the hand, foot, facial or lingual muscles. Dystonia gets aggravated by voluntary action for e.g. walking. We present a case of foot dystonia secondary to stroke, which was treated with Functional Electrical Stimulation (FES).

## CASE STUDY

A 20 year old male presented in the Dept. Physiotherapy department with complaint of twisting of right foot while walking, since 2 years. He was diagnosed with bilateral middle cerebral artery infarct in 2010 (3 years back) and had suffered from Rt hemiparesis & Lt hemiparesis. The hemiparesis gradually improved and although he was able to walk independently around 9 months post infarct, he developed circumductory gait and inward twisting of right foot. He had also developed hearing loss in left ear 4-5 months before having brain infarct. His past history revealed congenital talipoequino-varus in right foot which was corrected through serial casting. The patient reported that he was walking normally before developing infarct and had a good walking speed.

There was no other significant medical or surgical history.

He was diagnosed with post-stroke right right foot dystonia by a neurologist and was put on dopaminergic drugs (Syndopa Plus and Parkin) and anti-spastic medications (Liofen 10 mg TDS). He continued these medications for almost 3 months, but did not get any relief. He was given botox injection but he gained no relief even after that. He was advised physiotherapy in the form of home exercise plan that included stretching of gastro-soleus muscle, strengthening of dorsiflexors and evertors and some weight bearing exercises to improve balancing on right leg. The patient reported no relief with any of the treatments.

Because of no improvement seen after the home based physiotherapy; the patient was even the option of SES. The initial examination showed the patient to be cooperative, following commands; he had a low volume unclear speech although intelligible. His Mini Mental Status Score was 29/30 with difficulty in recall. The motor examination showed the resting position of foot was in ankle inversion (200) and toes in flexion which increased while walking. He had a circumductory gait pattern, with knee going into hyper extension and foot going into planterflexion and inversion and toes into flexion. Muscle tone was normal but he had tightness in right ankle invertors and plantar flexors. Knee and ankle jerks were brisk and ankle clonus was present. He had 50 of ankle eversion and 200 of ankle dorsiflexion from the neutral position. He had good strength in hip muscles, knee extensors and ankle plantar flexors (Grade 4/5), and fair strength in right dorsiflexors, evertors, toe extensors and knee flexors (Grade 3/5). His sensory examination was normal. His BBS was 50/56 and his walking speed was 0.644 m/sec as measured on 10 meter walk test.

The ODFS pace device was used for stimulating his right evertors and dorsiflexors while walking. He was made to practice walking with the help of FES for 30 minutes every day, 6 days a week for 4 weeks. In addition to FES, he was put on an exercise programme. The exercises included gastro-soleus stretching, dorsiflexion and eversion training, gait training, standing balance exercises (tandem walking, tandem stance, braided walking, walking up and down the ramp, single leg stance, marching, heel stance, squats, alternate leg lifting with knee extended, stair climbing) hamstrings curl. He was also prescribed AFO for right foot. Despite all this, he continued to report no significant reduction in dystonia and had the same gait difficulty i.e. twisting of right foot while

walking. His ankle range of motion remained unchanged. However his BBS increased to 54/56 and his gait speed was 0.677 m/sec as measured on 10 meter walk test.

## DISCUSSION

FES is a novel symptomatic treatment for the abnormal contractions present during dystonia. The reason behind using FES for dystonia is that by electrically stimulating the common peroneal nerve during the swing phase of gait we could achieve dorsiflexion and eversion of the foot and overcome the patient's dystonia (plantar flexion and inversion).<sup>9</sup> FES produces functional movement that induces afferent-efferent stimulation which results in limb movements along with cutaneous and proprioceptive inputs, reminding the patients on how to perform the movement properly. The possible mechanisms underlying the development of dystonia are exuberant synaptic plasticity and altered sensorimotor organization. FES, by promoting dorsiflexion during gait cycle and increasing the afferent input, has the capability of affecting central sensorimotor pathways and modify central sensorimotor maps thus leading to motor relearning.

The mild improvement seen in berg balance score and gait speed seen in the patient could be due to practice of walking with FES and balance exercises performed. Despite using the FES, patient continues to experience the same gait difficulty i.e. twisting of right leg while walking although he reports having gained confidence while walking. FES if could be used for longer periods of time during the day might have shows reduction in twisting of foot. There is large evidence for the efficacy of FES to correct foot drop following stroke. Researchers have reported improvement in walking speed, energy cost of walking, quality of life, range of motion and dorsiflexor muscle strength with the use of FES in stroke population; however there is limited data for the role of FES in treating dystonia.

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