

CASE STUDY- PATIENT WITH DYSTONIA

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Diagnosis and history

Mrs. W is a 49 year old teacher. She first started experiencing symptoms of dystonia in her left foot in 2007, but attributed it to a running injury (she used to regularly compete in marathons). Symptoms spread into the other foot and then more proximally into her knee and hip joints.

Subjective assessment

Mrs. W's life had changed dramatically since her diagnosis of dystonia. She was relying on a wheelchair for getting around school and aids like a shower stool were needed at home as she could no longer stand for any period. She complained of poor circulation and pins and needles in her feet.

Objective assessment

BIOMECHANICS The dystonia had dramatically altered her lower limb biomechanics. The high tone in her calf caused strong plantarflexion of the right foot, reducing her base of support considerably. She was issued with a custom-made hinged ankle-foot-orthosis (AFO), which allowed her to weight bear better on her right side. When her left foot started to follow the same biomechanical pattern she "forced" her heel to stay on the floor, thus keeping a better base of support, but forcing her foot into inversion. Mrs. W's knees were unable to extend fully- limited to 45° flexion on passive stretching. Her left foot was severely limited in passive and active movements- only being able to move from 10° plantarflexion to plantargrade. Her right foot was restricted in active and passive movements into dorsiflexion with end range of movement at 10° off plantargrade.

GAIT Walking for short distances was very difficult. She had to walk quickly to prevent herself from falling over. Her hips were externally rotated and knees flexed at 45° in varus. Both feet were inverted. The right foot was plantarflexed and she was weight bearing through the metatarsals of that foot and the lateral border of her left foot. She therefore had a small base of support and poor stability (figure 1).

Treatment

Mrs. W was set up with FES for walking for her *left leg only* as it responded better to stimulation than her right leg due to the limited dorsiflexion on the right. Stimulation was triggered for the left leg with a switch beneath the lateral border of her left heel which turned stimulation on at heel rise and off 200ms after heel strike. After using FES for six weeks on her left leg FES was set up for walking with her *right leg as well*. The most consistent method for triggering stimulation for both legs was by using one footswitch placed under the left heel. Triggering for the left leg remained the same, however the right leg was triggered to start 200ms after left heel strike and to stop 300ms after left heel rise.

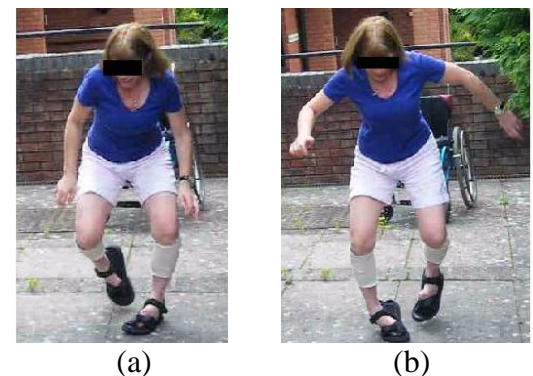


Figure 1 Mrs. W.'s walking before FES
(a) left stance (b) right stance

Outcomes

BIOMECHANICAL CHANGES



(a)

(b)

Figure 2 *Walking (a) before FES treatment and (b) six weeks into FES treatment*

The most improvement was seen in the first six weeks of treatment. There was considerable change in the visual biomechanical alignment of her lower limbs during this period. Her hips were less externally rotated, her knees were less varus and the contact of her left foot on the floor increased considerably (figure 2). This allowed her to stand for longer periods, for example she was able to take a shower standing again rather than needing a seat. The FES has had some training effect in keeping Mrs. W's left foot better aligned. When the FES is off for short periods her left foot does not return to the original inverted position. She does, however need to keep using the FES to maintain these corrections. Mrs. W had a weekend without FES and the "bowing" of her knees and loss of weight bearing on the left leg began to return.

CHANGES IN WALKING SPEED

Walking speed over 10 metres was assessed at 6 and 18 weeks after the start of treatment. There was no immediate increase in her walking speed when comparing with and without stimulation (orthotic effect) when she was setup with FES for walking on her left leg. There was a small orthotic effect of 11% at six weeks, but the main gain was the training effect that had occurred during this period. This was demonstrated by an increase in walking speed of 137% in her non-stimulated walking. Three months later there was no further improvement in her walking speed without FES, however there still was a small orthotic effect of 12%.

The response of her right leg to stimulation was not as good as the left. Mrs. W. still needs to use an AFO to support her right ankle even when using FES (figure 3). It appears that the tone in the right calf is much greater and therefore more difficult to overcome and achieve a good dorsiflexion movement.



Figure 3 *right foot in stance with AFO*

FUTURE TREATMENT Mrs. W. is continuing to use FES in walking for both legs. She has begun exercise stimulation of her quadriceps muscles to see if this will reduce her hamstrings tone and therefore improve knee extension and lower limb alignment in stance. In the future we may consider supplementing her current FES programme with stimulation of the quadriceps muscles in the stance phase of gait. It is unclear whether Mrs. W. will continue to improve or whether she has reached a plateau, she still has hopes of returning to running.

Mrs. W.'s perception of changes

"Before using FES I had resigned myself to using a wheelchair, I was no longer able to stand...

Since starting to use FES the effect was immediate.... my bent foot straightened to the floor...

I grew one and a half inches! To date I have never gone back to my chair, it now stands unused in the shed. I just can't believe the difference it has made."

Discussion

There is no doubt that FES had a dramatic effect at improving Mrs. W.'s quality of life. Some clinicians may be wary of using FES in patients with dystonia as some people report an increase in spasms. However this case study shows that there is a place for trying it. Mrs. W. felt that if FES had been applied sooner she would have been able to reduce the biomechanical changes to her legs and perhaps have prevented the high tone that remains in her right calf.

It would also be interesting to look at the combination of FES with botulinum toxin for dystonic patients as botulinum toxin is often used for these patients. It may be that the combined effect of these treatments would further reduce the high tone, improve biomechanical alignment and therefore improve function. Although the stimulation was limited to the dorsiflexor and evertor muscles the response also affected the alignment of Mrs. W.'s hips and knees. The underlying mechanism for these changes is poorly understood but it may be worth considering using FES to help improve proximal alignment when applying FES more distally.