

Case Study: Multi-faceted, long-term use of Functional Electrical Stimulation (FES) by an Individual with Primary Progressive Multiple Sclerosis (PPMS) and Ankylosing Spondylitis (AS)

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57 year old male. Diagnosed PPMS in 2009 aged 43. Expanded Disability Status Scale (EDSS) = 6.0 Past Medical History (PMH): AS diagnosed aged 27

FES Journey

03/02/2015: Initial assessment at FES Clinic
Full time production manager. Tried 'foot up' orthotic but stopped using as found uncomfortable. Lives with wife and adult daughter in house with stairs. Has downstairs bedroom and bathroom if needed.
Walking unaided. Gait Analysis: Demonstrates active dorsiflexion but fatigues quickly, inconsistent heel strike. Increased hip and knee flexion to help clear foot. Walking 100-500m before needing a rest.
Fitted with PACE for walking¹.

16/04/2015: 6/52 Review: Uses PACE 6-7 days a week when going out the house. Does not use in house. Great initial outcomes (see outcome measures). Seen for ongoing yearly reviews.

01/02/2017: Continues to use PACE at same frequency. Set up with PACE XL.

29/01/2018: Mobility increasingly difficult over last year- using walking stick outdoors only.

31/01/2019: Complaint of right shoulder pain due to reduced scapular control and weakness. Set up with exercise mode to supraspinatus and middle deltoid.

13/01/2020: discontinued UL FES until pain better controlled.

22/11/2021: MS2 set up for quadriceps, hamstrings and wrist and finger extensors.

21/12/2022: MS2 also set up for scapular retraction 'hugging' position. Ongoing severe nerve pain and periodic muscle spasms. Treated with several medications. Consultants undecided which relate to MS and which related to AS. Ongoing use of Pace XL 6 x weekly when going out of the house. Still in employment and mobile

Pace XL

Parameter	Recorded setting
Walking set up	DFHR
Pulse width	50%
Current	78mA
Rising ramp	50ms
Extension	100ms
Falling ramp	200ms
Time out	2500ms
Delay	0ms
Frequency	40Hz
Wave form	ASYM

FES Parameters

Microstim (MS2)

Muscle group	Mode	Output level (x10 mA)
Quadriceps	6	4.75
Hamstrings	6	5.50
Extensor forearm	6	4.00
Scapula 'hug' (rhomboids, latissimus dorsi)	6	5.00

Outcome Measures

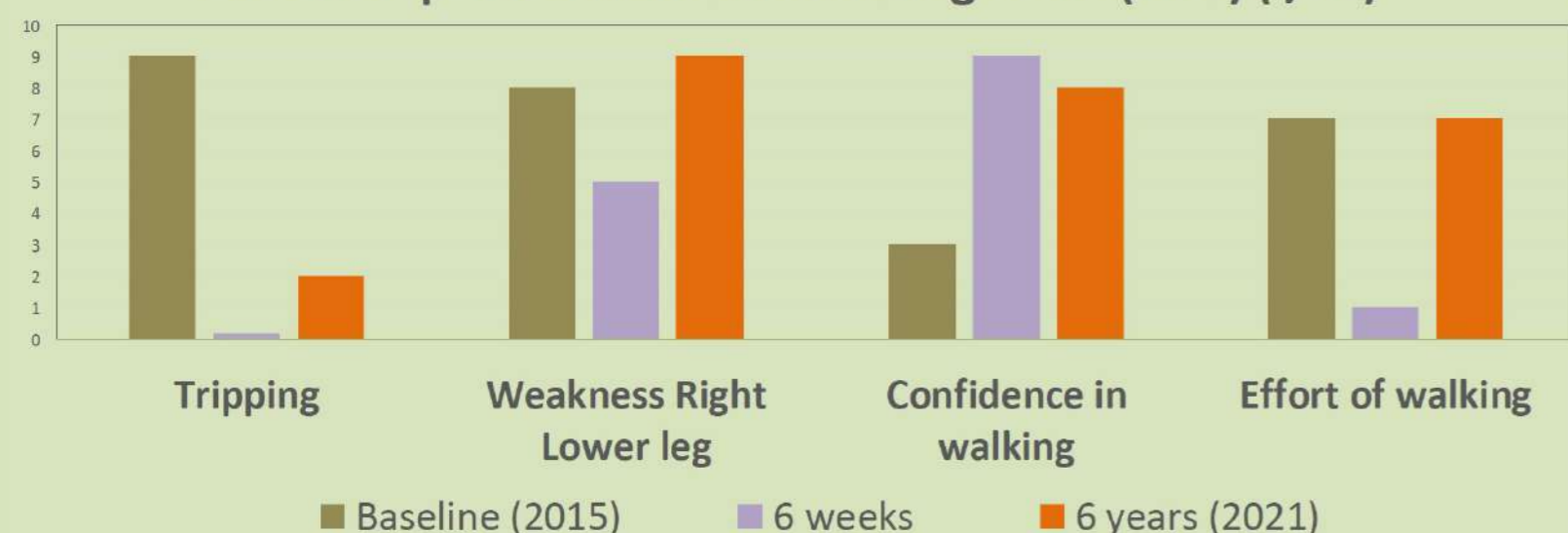
(s = seconds), m/s = metres per second)

		Baseline 2015	2019	2022
FES Off	10m walk	9.57s	11.10s	18.22s
FES Off	Steps taken	15	18	22
FES Off	Walk speed	1.05m/s	0.9m/s	0.55m/s
FES On	10m walk	8.32 s	9.35 s	13.94s
FES On	Steps taken	14	16	20
FES On	Walk Speed	1.2 m/s	1.07 m/s	0.72 m/s
FES Orthotic Effect on speed		↑15%	↑21%	↑31

Despite progression of MS & AS causing reduced walking speed over 7 years, long-term FES use continues to give a significant orthotic effect on walking speed and subjective benefits regarding tripping and confidence in walking^{2,3}

NRS score	Baseline 2015	6 weeks	6 years 2021
Tripping	9/10	0/10	FES on 2/10 FES off 8/10
Confidence in walking	3/10	9/10	FES on 8/10 FES off 4/10
Effort of walking	7/10	1/10	7/10
Weakness in Right Lower Leg	8/10	5/10	9/10

Patient reported Numerical Rating Scale (NRS) (/10)



FES has been a game changer!

FES is helping me to exercise the fading muscles my brain and nerves have fallen out with - not just legs, arms and shoulders too

With FES



The number of trips and falls it has prevented can only be guessed at!

I never leave home without my trust 9 Volt 'leg'!



References:

- NICE guideline (NG220) MS in adults: management (2022)
- NICE interventional procedure guideline (IPG 278) FES for drop foot of central neurological origin (2009)
- Street, T., & Singleton, C. (2018). Five-Year Follow-up of a Longitudinal Cohort Study of the Effectiveness of Functional Electrical Stimulation for People with Multiple Sclerosis. International journal of MS care, 20(5), 224-230. <https://doi.org/10.7224/1537-2073.2016-094>

With grateful thanks to the patient for allowing us to share his FES journey.



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