

**A Combination of Constraint-Induced Therapy and Motor Control Retraining in the Treatment of Focal Hand Dystonia in Musicians - Case Studies of a Guitarist and Flutist**

Patrice Berque\*, BSc (Hons) MCSP, Heather Gray<sup>§</sup>, MSc MCSP,  
Cassandra Harkness<sup>#</sup>, BSc MCSP, Angus McFadyen<sup>δ</sup>, PhD

\* Specialist Musculoskeletal Chartered Physiotherapist, Department of Physiotherapy, Glasgow Royal Infirmary, Glasgow, Scotland, UK / Private Practitioner and Founder of a Musicians' Clinic in Glasgow, in collaboration with the Musicians Union Scotland, and the British Association for Performing Arts Medicine, London.

<sup>§</sup> Senior Lecturer in Physiotherapy, School of Health and Social Care, Glasgow Caledonian University, Glasgow, Scotland, UK.

<sup>#</sup> Chartered Physiotherapist and Specialist Hand Therapist, Canniesburn Plastic Surgery Unit, Glasgow Royal Infirmary, Glasgow, Scotland, UK.

<sup>δ</sup> Reader in Health Statistics, School of Engineering and Computing, Glasgow Caledonian University, Glasgow, Scotland, UK.

**ABSTRACT**

**Introduction**

Focal hand dystonia (FHD) in musicians is a painless task-specific motor disorder characterized by an involuntary loss of control and coordination of individual finger movements (figure 1).<sup>1,2</sup> It is associated with decreased cortical inhibition,<sup>3</sup> and maladaptive cortical reorganisation showing fusion of the representational zones of the digits in the primary somatosensory cortex.<sup>4</sup> Research into rehabilitation strategies for FHD is lacking.<sup>5</sup> The aim of this study was to investigate the effects of an innovative behavioural therapy intervention, aimed at normalising movement patterns, in two musicians affected by FHD.

**Methods**

Two professional musicians, a 53 year old guitarist and 48 year old flutist, volunteered to take part in this novel retraining protocol. Intensive constraint-induced therapy<sup>6</sup> involved playing specific finger combinations for the dystonic finger, with a splint immobilising the compensatory digit (figure 2). Motor control retraining involved playing without splints at slow speed, while maintaining good movement patterns. Video recordings of the subjects playing an easy and a medium difficulty piece were used for data analysis every two months up to 12 months. The Frequency of Abnormal Movements scale (FAM)<sup>7</sup> and the change in metronome speed achieved during motor control retraining<sup>8</sup> were chosen as outcome measures. It was hypothesised that there would be significant differences in the FAM scores and metronome speeds achieved over time.

**Results**

Results revealed that the mean number of abnormal movements per second of instrumental playing decreased by approximately 80% over the treatment period for both pieces (table 1)(figure 3). Results also showed a trend towards a substantial increase in the metronome speed achieved with good motor control (table 2).

**Discussion**

These preliminary results suggest that this innovative protocol may be of great value for the treatment of musicians affected by FHD, with a trend towards normalisation of movement patterns. Tailored task-specific retraining<sup>9</sup> may allow normal cortical segregation to be re-established and normal fine motor control to be restored.<sup>10</sup>

**Keywords**

Focal dystonia; Hand injuries; Musicians; Motor control; Rehabilitation; Cortical plasticity; Sensory motor performance; Movement disorder.

## **References**

1. Lim VK, Altenmüller E, Bradshaw JL: Focal dystonia: current theories. *Human Movement Science* 2001; 20:875-914.
2. Charness ME, Schlaug G: Brain mapping in musicians with focal task-specific dystonia. *Dystonia 4: Adv Neurol* 2004; 94:231-238.
3. Hallett M: Dystonia: abnormal movements result from loss of inhibition. *Dystonia 4: Adv in Neurol* 2004; 94:1-9.
4. Elbert T, Candia V, Altenmüller E, Rau H, Sterr A, Rockstroh B, Pantev C, Taub E: Alteration of digital representations in somatosensory cortex in focal hand dystonia. *Neuroreport* 1998; 9:3571-3575.
5. Jabusch HC, Zschucke D, Schmidt A, Schuele S, Altenmüller E: Focal dystonia in musicians: treatment strategies and long-term outcome in 144 patients. *Movement Disorders* 2005; 20(12):1623-1626.
6. Candia V, Schäfer T, Taub E, Rau H, Altenmüller E, Rockstroh B, Elbert T: Sensory motor retuning : a behavioural treatment for focal hand dystonia of pianists and guitarists. *Arch Phys Med Rehab* 2002; 83:1342-1348.
7. Spector JT, Brandfonbrener AG: A new method for quantification of musician's dystonia: the frequency of abnormal movements scale. *Med Probl Perform Art* 2005; 20:157-162.
8. Sakai N: Slow-down exercise for the treatment of focal hand dystonia in pianists. *Med Probl Perform Art* 2006; 21:25-28.
9. Van Vliet P, Heneghan NR: Motor control and the management of musculoskeletal dysfunction. *Manual Ther* 2006; 11:208-213.
10. Byl NN: Focal hand dystonia may result from aberrant neuroplasticity. *Dystonia 4: Adv in Neurol* 2004; 94:19-28.

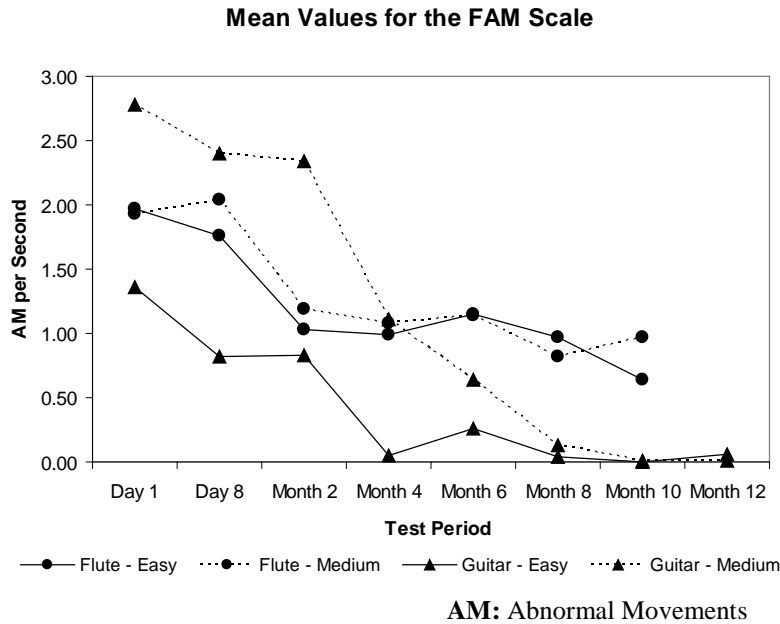
**FIGURE 1.** Dystonic pattern for the flute player: maintained flexion of D5.



**FIGURE 2.** Constraint-induced therapy for both players.



**FIGURE 3.** Frequency of abnormal movements (FAM) scale: mean values for each subject and for each piece.



**TABLE 1.** FAM Scale: Mean Values for Both Subjects, Expressed in Number of Abnormal Movements per Second.

	Easy Piece		Medium Piece	
	Mean	SD*	Mean	SD*
Day 1	1.67	0.4313	2.36	0.6010
Day 8	1.29	0.6647	2.22	0.2546
Month 2	0.93	0.1414	1.77	0.8132
Month 4	0.52	0.6647	1.10	0.0212
Month 6	0.71	0.6293	0.89	0.3536
Month 8	0.51	0.6576	0.48	0.4879
Month 10	0.32	0.4525	0.49	0.6788
Month 12 <sup>§</sup>	N/A	N/A	N/A	N/A

<sup>§</sup> No mean data available for month 12, since the flute player was excluded after month 10 following injection of 40 units of disport into the ulnar portion of the left flexor digitorum profundus of the fifth finger.

\* Standard deviation.

**TABLE 2.** Metronome Speed Scores for Both Subjects and Both Musical Pieces, Expressed in Beats Per Minute (bpm).

	Guitar Player		Flute Player <sup>†</sup>	
	Easy <sup>§</sup>	Medium <sup>#</sup>	Easy <sup>*</sup>	Medium <sup>‡</sup>
Day 1	44	34	15	12.5
Day 8	56	52	16.5	13.5
Month 2	63	60	18	13.5
Month 4	76	66	21	19
Month 6	80	72	24	20
Month 8	104	126	28	23
Month 10	120	126	33	33
Month 12	120	126	-	-

<sup>†</sup> Scores were calculated over 10 months only. After this, the flute player received a botulinum toxin injection and was excluded from the study.

<sup>§</sup> Normal tempo for easy piece was 69bpm.

<sup>#</sup> Normal tempo for medium difficulty piece was 88bpm.

<sup>\*</sup> Normal tempo for easy piece was 66bpm.

<sup>‡</sup> Normal tempo for medium difficulty piece was 66bpm.