A Combination of Constraint-Induced Therapy and Motor Control Retraining in the Treatment of Focal Hand Dystonia in Musicians

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Focal Hand Dystonia

(Elbert et al. 1998, Lederman 2002, Schuele & Lederman 2003, Brandfonbrener et al. 2004, Frucht 2004, Lim et al. 2004, Frucht 2009, Altenmuller & Jabusch 2010)

- Painless motor disorder.
- Involuntary loss of fine motor control and coordination of individual finger movements.
- Deterioration of sensorimotor skills, task-specific.
- Usually involving 3rd to 5th digits.
- Estimated prevalence of less than 1% of the population of professional musicians.

Flute Player – Day 1

(Berque et al., 2010)

Focal Hand Dystonia Neurological Changes

(Chen & Hallett 1998, Elbert et al. 1998, Hallett 1998, Bara-Jimenez et al. 2000, Charness 2004, Hallett 2004, Lin & Hallett 2009, Altenmuller & Jabusch 2010)

- Reduced inhibition and increased excitation at spinal cord, brainstem, and cortical levels, leading to excessive motor output with overflow into inappropriate muscles.
- This would explain co-contraction of agonist and antagonist muscles observed in FHD.
- Altered sensory perception and maladaptive cortical plasticity.
- Impaired sensorimotor integration.

Fusion of Cortical Representations

(Elbert et al., 1998)

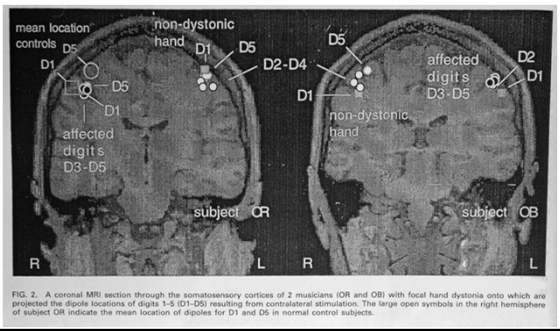


FIG. 2. A coronal MRI section through the somatosensory cortices of 2 musicians (OR and OB) with focal hand dystonia onto which are projected the dipole locations of digits 1–5 (D1–D5) resulting from contralateral stimulation. The large open symbols in the right hemisphere of subject OR indicate the mean location of dipoles for D1 and D5 in normal control subjects.

FHD – Management Strategies

- Candia et al. (2002): Constraint-induced therapy;
- Spector & Brandfonbrener (2005): Constraint-induced therapy;
- Zeuner et al. (2005): Motor training programme in writer's cramp;
- Sakai (2006): Motor Control Retraining – "Slow-Down Exercise".

AIMS

- Investigate the effects of a combined behavioural therapy over a 12-month period in musicians affected by FHD:
  - Constraint-induced therapy.
  - Motor control retraining (Slow-Down Exercise).

Subjects

Instrument	Dystonia	Side	Onset	Compliance
Guitar 1	D3, D4, D5	R	2006	**95%**
Guitar 2	D3, D4, D5	R	1982	**76%**
Flute 1	D4, D5	L	2002 (D5) 2006 (D4)	**95%**
Flute 2	D4, D5	R	2004	**95%**
Piper 1	D5	R	2005	**77%**
Piper 2	D3, D4	R	1995	**40%**
Oboe	D4, D5	R	2006	**88%**
Accordeon	D3, Wrist, D2, D4	R	2005	**N/A**

Subjects

Outcome Measures

- 2 test pieces: easy and medium difficulty;
- Frequency of Abnormal Movements (FAM) scale (Spector & Brandfonbrener, 2005);
- 2 ordinal Dystonia Evaluation Scales (DES): Tubiana & Chamagne Scale, Arm Dystonia Disability Scale;
- Change in metronome speed achieved during Slow-Down Exercise (Sakai, 2006).

Hypothesis

Significant differences in Frequency of Abnormal Movement Scale scores and metronome speeds would be achieved between testing sessions over time for both pieces.

Study Design

- Repeated Measures Design: subjects tested at Day 1, Day 8, then every 2 months;
- Standardised protocol;
- Standardised metronome speed for each piece.

Constraint-Induced Therapy

(Berque et al., 2010)

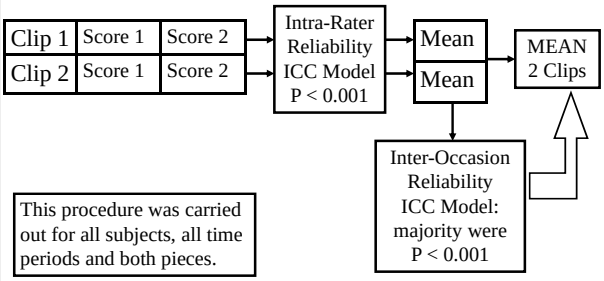
Constraint Induced Therapy

(Berque et al., 2010)

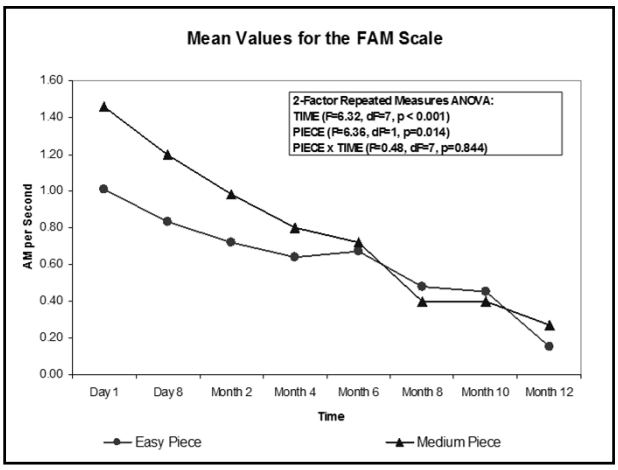
Home Protocol

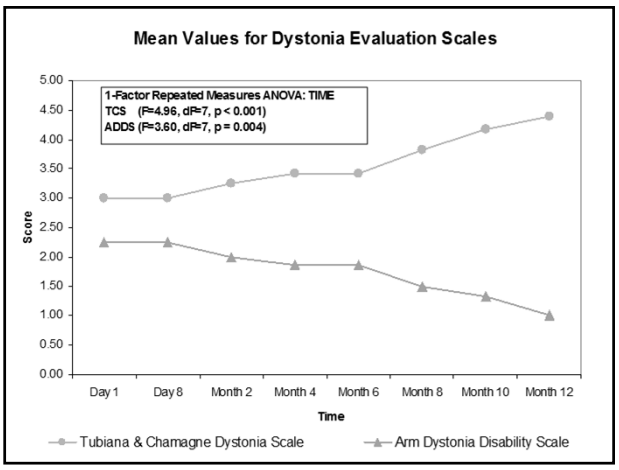
- Week 1: constraint-induced therapy only. 2 hours per day;
- Constraint-induced: ½ hour to 1 hour per day;
- Slow-Down Exercise: ½ hour per day;
- Free playing: ½ hour per day for motivation and compliance.

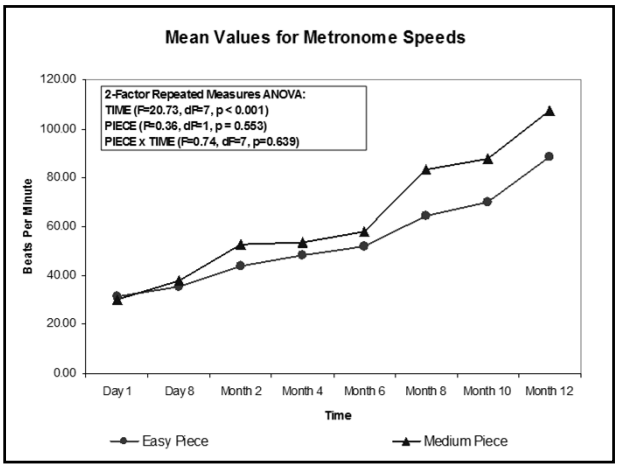
Reliability Tests



This procedure was carried out for all subjects, all time periods and both pieces.







Flute Player – Month 10

(Berque et al., 2010)

Limitations

- No control group;
- Small sample;
- Missing data for the medium difficulty piece;
- Two strategies were used.

Clinical Recommendations

- Repeated Measures Design is a robust study design;
- This study confirms the use of the FAM as a valid clinical tool;
- Retraining should take place for more than 8 months. 1 year could be set as a standard;
- One test piece may be sufficient;
- Close monitoring of subject compliance required.

Co-authors

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- Cassandra Harkness, Hand Therapist Physiotherapist, Canniesburn, GRI.
- Angus McFadyen, Reader in Health Statistics, GCU.

A Combination of Constraint-induced Therapy and Motor Control Retraining in the Treatment of Focal Hand Dystonia in Musicians

Patrice Berque, BSc (Hons), MCSP, Heather Gray, MSc, MCSP, Cassandra Harkness, BSc, MCSP, and Angus McFadyen, PhD

Focal hand dystonia (FHD) in musicians is a painless task-specific motor disorder characterized by an involuntary loss of control of individual finger movements. The aim of this study was to investigate the effects of an innovative behavioural therapy intervention, aimed at normalising movement patterns, in musicians affected by FHD. **Methods** Eight musicians volunteered to take part in this retraining protocol. Intensive constraint-induced therapy and motor control retraining at slow speed were the interventions. Video recordings of the subjects playing two pieces were used for data analysis. The Frequency of Abnormal Movements scale (FAM), the change in metronome speed achieved during motor control retraining, and two ordinal dystonia evaluation scales were chosen as outcome measures. It was hypothesised that there would be significant differences in the FAM scores and metronome speeds over a 12-month period. **Results** For the main outcome measure, the FAM scale scores, the two-factor repeated measures ANOVA revealed a very significant decrease in the number of abnormal movements per second of instrumental playing over the 12-month period ($F = 6.32$, $df = 7$, $p < 0.001$). Tukey's post-hoc tests carried out for the FAM scores revealed that significant changes occurred after 8 months of therapy. **Discussion** These results suggest that a combination of constraint-induced therapy and specific motor control retraining may be a successful strategy for the treatment of musicians' FHD. Furthermore, the results suggest that retraining strategies may need to be carried out for at least 8 months before statistically significant changes are noted. *Med Probl Perform Art* 2010; 25:139-153.

LITERATURE REVIEW

untary loss of control and coordination of individual finger movements.[1-4] It is a disorder associated with a sudden or insidious deterioration of sensorimotor skills which, in most cases, only occurs in the context of instrument playing.[5-7] Involuntary spasms, cramping sensations, abnormal hand posture, finger curling, loss of coordination during specific fingerings, fingers sticking on the keys of the instrument, irregularities in rhythm and tempi are common findings.[3,5,8-12] It more often involves digits 3, 4, and 5 (D3 to D5) of the hand[2,4,13,14] and is thought to be related to the intense and prolonged practice of rapid, alternating, and highly precise finger movement patterns.[2,4,5,14] The condition can be disabling enough to curtail a professional career.[2,9,15,16]

Prevalence Amongst Musicians

FTSD has been estimated to affect between 5% and 14% of musicians consulting performing arts clinics in the US.[4,15,17] This would give an estimated prevalence of 0.2% to 0.5% in the population of professional musicians.[3,4,18] Focal hand dystonia (FHD) occurs much more frequently in males than females. One study[11,19] revealed that 73% of instrumentalists affected were men, two others reported 80%[18] and 83%[3]. Symptoms usually begin in the third or fourth decade.[4,11,16,17]