A Combination of Constraint-induced Therapy and Motor Control Retraining in the Treatment of Focal Hand Dystonia in Musicians
A Long-term Follow-up Study

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Introduction
Focal hand dystonia (FHD) in musicians is a painless task-specific motor disorder characterized by involuntary loss of control of individual finger movements (Fig. 1). It is associated with decreased cortical inhibition, and maladaptive cortical reorganization showing fusion of the representational zones of the digits in the primary somatosensory cortex.1 Research investigating the long-term effects of rehabilitation strategies for FHD is lacking.

Alms
The aim of this study was to investigate the long-term effects of a combined behavioural therapy intervention, aimed at normalising finger movement patterns.

Methods
• Eight musicians with FHD volunteered to take part. Six musicians completed the initial 1-year period, and four agreed to participate in the 4-year follow-up.
• Inclusion and exclusion criteria were checked again, and all four participants met them.
• One year of intensive constraint-induced therapy (Fig. 1) and motor control retraining at slow speed were the interventions.2
• Participants would practice their specific exercises between one and two hours each day during the initial intensive 1-year period.
• Participants were no longer monitored between the end of the intensive 1-year period and follow-up at year 4.
• A quasi-experimental repeated measures (within-subject) design was used, with 9 testing sessions over 4 years.
• Video recordings of the subjects playing two pieces of music were used for data analysis.
• The Frequency of Abnormal Movements scale (FAM),3 and two ordinal Dystonia Evaluation Scales (DES)4,5 were chosen as outcome measures.
• It was hypothesized that there would be significant differences in FAM scores and DES scores achieved over the 4-year period.

Results
1. Reliability Testing of the Outcome Measures
Intra-rater, inter-rater, and test-retest reliability were tested using an intraclass correlation model: ICC Model (2,1).6
FAM Scale:
• Inter-rater reliability: Excellent with ICC = 0.985-0.999, p < 0.001, narrow 95% confidence intervals (CI) = 0.985 – 1.000).
• Test-retest reliability: Good to very good, with ICC = 0.739 – 0.996, majority with p < 0.001, but wider 95% CI.
Dystonia Evaluation Scales:
• Intra-rater reliability: ICC = 0.700 – 1.000 with fairly narrow 95% CI (0.600 – 0.999).
• Inter-rater reliability: ICC = 0.760 – 0.900 with reasonable 95% CI (0.390 – 0.990).

2. FAM Scale Scores: Comparison over Time

![Image](https://via.placeholder.com/150)

**FIGURE 2.** frequency of abnormal movements (FAM) scale: mean values for each piece and all subjects.

• The results from the two-factor repeated measures ANOVA for the main outcome measure, the FAM scale scores, revealed that the mean number of abnormal movements (AM) per second of instrumental playing decreased significantly by approximately 80% for both pieces over the 4-year period (F = 7.85, df = 8, p < 0.001)(Fig. 2).
• Tukey’s post-hoc test revealed that statistically significant improvements occurred after 6 months of therapy (p-values between p < 0.001 and p = 0.044).
• Although the results were not significant between month 12 and follow-up at year 4, the trend revealed that the progress achieved during the first year of intensive retraining was maintained at year 4.

3. Dystonia Evaluation Scale Scores
• The results of the one-factor repeated measures ANOVA carried out for each DES revealed a statistically significant improvement in scores for both the Tubiana and Champagné Scale (F = 7.18, df = 8, p < 0.001) and the Arm Dystonia Disability Scale (F = 5.26, df = 8, p < 0.001) over the 4-year treatment period, in keeping with the trends observed for the FAM scale.

Conclusions & Recommendations
• A 1-year intensive retraining protocol combining constraint-induced therapy and motor control retraining may lead to long-term benefits for musicians with FHD, with a significant trend towards normalization of movement patterns over time.
• These results are very encouraging, and suggest that normalization of movement patterns and recovery of fine motor control occur through normalization of the cortical representational maps, and that these positive neuroplasticity changes are maintained in the long-term.
• Indeed, the progress achieved during the first year of intensive retraining was maintained at the 4-year follow-up with a minimum amount of daily specific practice, i.e. 15 to 30 minutes on average.
• Results also suggest that restraining strategies may need to be carried out for at least 6 months before statistically significant changes are noted.
• The FAM scale proves to be a useful and reliable clinical tool for measuring musician’s dystonia.
• The results from the reliability tests carried out for the Dystonia Evaluation Scales are encouraging, and show that these rating scales are reliable tools. However, further research is necessary to evaluate their validity.

References

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Further Information
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