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Differences in Physical Characteristics and Response to Rehabilitation for Patients with Hand Dystonia: Musicians' Cramp Compared to Writers' Cramp

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ABSTRACT:

Study Design: Pre-Post, Mixed Factorial Trial.

Introduction: Focal hand dystonia is a challenging movement disorder to rehabilitate in musicians and writers.

Purpose of the Study: To compare the neuromusculoskeletal characteristics of those with writers' cramp (WC) and musicians' cramp (MC), and evaluate responsiveness to learning-based sensorimotor training.

Methods: Twenty-seven individuals (14 musicians, 13 writers) participated in 8 weeks of supervised therapy supplemented with a home program. Between-group differences on measures of musculoskeletal (physical), sensory, and motor performance were evaluated at baseline and post-intervention.

Results: Subjects with MC had a higher level of functional independence and better range of motion, but less strength in the affected upper limb than those of subjects with WC. Subjects with MC demonstrated greater accuracy on graphesthesia, kinesthesia, and localization at baseline. No between-group differences in motor performance were noted at baseline or post-intervention. Following individually adapted learning-based sensorimotor training, both groups improved in musculoskeletal (physical) parameters, sensory processing, and motor control; however, improvements on certain subtests differed by group. At follow-up, differences in posture, ROM, strength, graphesthesia, and kinesthesia persisted between the groups.

Conclusions: Subjects with WC have different physical and performance risk factors compared with those of subjects with MC. Intervention paradigms are efficacious, but variable responses to rehabilitation occur.

Level of Evidence: 4.

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Focal hand dystonia (FHD) is typically characterized by abnormal movements of the digits and hand during the performance of task-specific, repetitive, rapid, skilled, fine motor movements.[1–3] Examples of the tasks affected by FHD include handwriting (writers' cramp [WC]), playing a musical instrument (musicians' cramp [MC]), or computer keyboarding (keyboarders' cramp). One of the challenges of treating patients with FHD is the variability in presentation (e.g., digits affected, type of abnormal movement pattern, side of the body, dominant/nondominant hand, severity, involvement of adjacent body parts, and type of task disrupted). As investigators continue to clarify the anatomical, physiological, and behavioral components of FHD, an appreciation of the complexities of the disorder is emerging.

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Although our understanding of the sensorimotor[4–59] and clinical[5,6,8,9,13,24,60–63] manifestations of FHD has improved over the past several years, at this time, the specific, discrete differences underlying the various presentations of FHD are not entirely clear.

SIMILARITIES AND DIFFERENCES BETWEEN MUSICIANS AND WRITERS

A review of the literature suggests that patients with WC and MC share a number of commonalities in terms of symptom onset and characteristics.[5,6,8,9,13,24,60–63] In general, the characteristics of patients with WC[1,2,4,17,19,20,30,37,40,41,44,49,56,64–71] have been more thoroughly described in the literature than those of patients with MC.[8,61,62,72–76] Confounding our understanding of FHD in musicians is the evidence that cortical and behavioral differences also are known to exist in skilled musicians as compared to nonmusicians.[76–79]

The patterns of use (e.g., intensive, bimanual use for musicians vs. precision grip for writers[80]) and movement abnormalities typically differ between musicians and writers with FHD. Patients with WC often exhibit an abnormal flexor pattern in the dominant hand, whereas either the dominant or nondominant hand may be affected in MC. In MC, the digits may either fly into extension or curl up into flexion, with the middle, ring, and small fingers most frequently affected.[62] Although both groups may exhibit alterations in cortical inhibition and activation,[18,23,33,44,45,47,48,50–54,81,82] sensorimotor organization and processing may differ between those with WC and those with MC.[81,82] Specifically, patients with MC may fit the model of sensorimotor training-induced FHD,[7] but patients with WC may not.[81]

As differences in the etiology and presentation of MC and WC unfold, so too may potential differential responses to treatment for the two groups. A number of treatment interventions for FHD have been proposed over the years,[7–9,13,44,73,82–92] but differentiating each group's responses to intervention may help investigators tailor treatment more appropriately. The purpose of this study is to examine differences in physical, sensory, and motor parameters between subjects with WC and those with MC at baseline and following eight weeks of learning-based sensorimotor retraining.

METHODS

All procedures for the study were approved by the University of California San Francisco (UCSF), the University of California San Diego (UCSD) Committee for Human Research, and the Institutional Review Board at Chapman University (CU). Informed consent was obtained by the study coordinator before the initiation of evaluation or treatment procedures.

Subjects

Subjects were recruited through the physical therapy faculty practice at UCSF, the Department of Physical Therapy at CU, and through neurologists associated with UCSD. The subjects are described in Table 1. All of the subjects had been diagnosed with FHD by a neurologist and had experienced some form of disability secondary to FHD for at least one year but no more than ten years. A total of 27 patients with FHD (13 with WC and 14 with MC) were enrolled in the study; however, three writers and four musicians did not complete the training program or return for follow-up testing. Subject availability for testing varied due to research protocol modifications; thus only six subjects had complete data for motor parameters and 17 subjects had complete data on sensory parameters, except for the graphesthesia test, completed by 16 subjects. The average ages for the groups were 42 (±11) years for the musicians and 44 (±10) years for the writers.

Outcome Measures

Outcome measures for the physical parameters included the following: 1) CAFE 40 physical function questionnaire results[93]; 2) posture scores and neural tension scores (based on percentage of ideal); 3) strength (extrinsic and intrinsic muscles of the forearm and hand, as measured by JAMAR™ (Sammons) and Microfet™ (Hogan Industries, Draper, UT) dynamometers and; 4) upper extremity range of motion (ROM) as a percentage of total possible. Sensory parameters included the following: 1) Stereognosis (measured by accuracy and speed on the Key Test); 2) Localization of point stimuli; 3) Graphesthesia and; 4) Kinesthesia. (The localization, graphesthesia, and kinesthesia tests are modifications of the Sensory Integration and Praxis Test[94] and are described in previous work[5,6,8,9,13] and in a related study in this issue [Byl et al, pp 175–189].) Motor performance outcomes included the

TABLE 1. **Summary of Participants**

	Gender		*Dominant Hand*		*Affected Hand*	
Diagnosis	*Male*	*Female*	*Right*	*Left*	*Right*	*Left*
MC ($n = 14$)	7	7	13	1	3	11
WC ($n = 13$)	4	9	11	2	9	4
Total ($n = 27$)	11	16	24	3	12	15

MC = musicians' cramp; WC = writers' cramp.