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The Hand That Has Forgotten Its Cunning—Lessons from Musicians' Hand Dystonia

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Video

Abstract: Focal task-specific dystonia of the musicians' hand (FTSDmh) is an occupational movement disorder that affects instrumental musicians and often derails careers. There has been speculation on the role of intense practice or the specific technical demands of various instruments as triggers for the development of FTSDmh. In this study, we review the clinical features of all published cases (899 patients) and 61 previously unpublished cases of FTSDmh. Our primary goals were to search for patterns in the clinical phenotype, and to discern if specific instrumental technical demands might be related to the development of dystonia. Symptoms of FTSDmh began at a mean age 35.7 years (SD = 10.6), with an overwhelming male predominance (M:F = 4.1:1). The right hand was preferentially affected in keyboard and plucked string players (77%), and the left hand in bowed string players (68%). Flexion movements were the most common dystonic movement in each instrument class, and fingers 3, 4, and 5, either in isolation or combination, were most frequently involved. The clinical implications of these findings and their possible relationship to the pathophysiology of focal task-specific dystonia are explored. © 2008 Movement Disorder Society
Key words: focal dystonia; music; hand

Focal task-specific dystonia of the musicians' hand (FTSDmh) is a disorder of motor control, affecting learned, highly skilled, fine hand movements. Abnormal postures, involuntary movements and loss of fine motor control occur exclusively during the execution of a specific task without weakness or sensory signs. Poore first reported musicians with professional impairment, elegantly coining the phrase "a hand that has forgotten its cunning,"[1] and Gowers was the first to draw a parallel between musicians' dystonia and other forms of focal dystonia of the hand affecting stenographers, telegraphists, draftsmen, and sportsmen.[2]

Professional musicians devote their careers to perfecting highly skilled, precise hand movements. Not only must they control the strength, pressure, amplitude, and kinetics of independent finger and hand movements, but they must reliably reproduce these movements under the intense pressure of public performance. Musicians typically begin training early in childhood, and likely only a small percentage of the population possesses the motor and aural skills needed for a professional career.

The development of FTSDmh is a watershed event in the life of a professional musician. As many as 1 in 200 musicians may be affected during their career,[3] and at performing arts medical centers 8 to 14% of musicians seeking medical attention are ultimately diagnosed with dystonia.[4–6] Symptoms usually begin in the fourth decade of life, a period when performers are at the peak of their careers, and once present rarely remit. Available therapies include botulinum toxin injection,[7–9] limb immobilization,[10] sensory-motor retraining,[11] and selective thalamotomy,[12,13] but most affected musicians do not return to their prior level of performance.

Recent studies support a dual role for genetic and environmental factors in the development of FTSDmh

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(M Hallett, personal communication). However, a definitive epidemiological study of FTSDmh presents formidable challenges. Since the disorder is uncommon, a prospective study to define incidence would require longitudinal follow-up of thousands of musicians. Further, symptoms of FTSDmh may begin in patients from ages 16 to 75, making identifying and tracking such patients difficult. Most important, professionals who develop FTSDmh often do not reveal their difficulty to their musical colleagues for fear of losing work, and others may simply stop playing professionally without being correctly diagnosed.

By reviewing the clinical features of nearly 1,000 patients with FTSDmh we hoped to create a comprehensive picture of the disorder, and also explore the possible relationships of instrumental demands to the development of the dystonic phenotype.

PATIENTS AND METHODS

We performed a systematic search of the world literature for cases of FTSDmh using the following databases: Medline, Cochrane, CINAHL (Cumulative Index to Nursing and Allied Health Literature) and AMED (Allied and Complementary Medicine) from inception to 2006. Inclusion criteria were: musician instrumentalists (both classical and other music styles, including professional, and amateur), with dystonia of the fingers, hand or wrist. Information on gender, age of onset, affected side, musical instrument, and pattern of dystonia was collected in a single database. When the same case appeared in sequential publications of the same author or group of authors it was counted once. Recognition of identical cases was based on finding at least three characteristics in common.

We identified 899 published cases (Table 1) and 61 previously unpublished cases seen by the authors. Clinical features of the 61 new patients are summarized in Table 2.

All affected musicians were grouped by class of instrument into one of six groups: woodwind (clarinet, flute, oboe, saxophone, bagpipe, and bassoon), plucked string (guitar, bass, banjo, harp, zither, mandolin, and koto), bowed string (violin, viola, and cello), keyboard (piano, organ, harpsichord, and accordion), percussion (drums, tabla, and bata) and brass (trumpet and French horn). Dystonic movements were classified as flexion, extension or a combination of both. Some patients exhibited a pattern of dystonia that differed from simple flexion or extension, described as "noncoordination," "slowness," "no control," etc. Because there were few such cases, we grouped them into a separate category named "other." In a few cases, the dystonic movement was described as "abduction" or "adduction;" these were also grouped in the category of "other." Patients with bilateral hand dystonia were counted once unless specifically noted.

RESULTS

Demographics

Symptoms of FTSDmh began between the ages of 16 and 75 years. The mean age of onset calculated on individual data available for 239 patients was 35.7 years, +/− SD 10.6 years. For 347 patients the age of onset was available as a mathematical mean, spanning onset at age 28 (SD 17) to 41.7 years (SD 18). Gender information was available on individual patients for 408 cases, of whom 328 (80%) were male, consistent with other published series.[14–18] Self-reported handedness information was available in 188 individuals, of which 165 (88%) were right-handed, 22 (12%) left-handed, and one ambidextrous. For 98 cases, the handedness was available as a group value, with a similar predominance of right-handed patients.[19,20] Information on the side of the dystonic hand was available for 644 cases. The right hand was affected in 409 cases (64%), the left hand in 209 (32%), and both hands (either at diagnosis or sequentially) in 26 cases (4%). Information on family history of dystonia was not available for most published series; within our own series of 61 patients, only one had an affected first-degree relative with dystonia (spasmodic dysphonia) documented on examination.

Which Fingers are Affected?

Because FTSDmh may affect either one or multiple fingers, we attempted to define where possible the various dystonic finger patterns. When both hands were affected, each hand was counted as an individual case. Information on the one finger involved by dystonia was available for 91 of 98 cases of single finger dystonia. Seven of these cases were from patients with bilateral dystonia. Figure 1 shows the frequency of single-digit dystonia in FTSDmh. Finger 3 was most commonly affected (37% of cases), followed by finger 2 (23%) and finger 4 (20%). Information on dystonia involving multiple fingers was available in 189 cases. Twenty-one of these cases were from patients with bilateral involvement. Figure 2 shows patterns of finger combinations occurring in musicians with dystonia. Four patterns occurred with highest frequency: combination 4, 5 (32%), combination 3, 4 (17%), combination 3, 4,

TABLE 1. *Source articles for reported patients*

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TABLE 2. *Clinical characteristics of 61 patients with FTSDmh seen at Columbia University Medical Center*

No.	Gender	Handedness	Instrument	Onset (years)	Dystonic hand	Pattern of dystonia
1	F	R	Accordion/piano	34	L	F234, E5, wrist E
2	M	–	Bagpipes	45	L	F45
3	M	R	Banjo	51	R	F2
4	M	R	Bass guitar	44	R	F23, Adduction3
5	F	L	Bassoon	35	L	F45
6	M	–	Clarinet	23	L	E345
7	M	R	Clarinet	45	R	E35, F34, wrist supination
8	M	R	Drums	45	L	F234, wrist F
9	M	R	Drums	41	R	Wrist F and ulnar deviation
10	M	R	Drums	22	L	Tremor
11	M	R	Drums	31	L	Wrist E, wrist radial deviation, E45
12	M	R	Drums (tabla)	39	R	Ulnar deviation of wrist
13	M	R	Flute/clarinet	41	R	F3
14	M	–	Flute	68	L	E3
15	F	R	Flute	51	L	F4
16	M	R	Flute	34	Bilateral	F45(left), E4F5(right)
17	M	L	Guitar	28	R	F3
18	M	R	Guitar	32	R	F3
19	M	R	Guitar	45	R	E25
20	M	R	Guitar	21	L	E4, F3
21	M	Ambidext.	Guitar	19	L	F45
22	M	–	Guitar	36	R	F345
23	M	R	Guitar	30	L	E25, F34
24	M	L	Guitar	44	Bilateral	Loss of control
25	M	R	Guitar	28	R	Adduction of 1, F45, wrist F
26	M	R	Guitar	30	R	F345
27	M	L	Guitar	39	R	F3, forearm pronation
28	M	L	Guitar	31	L	F2
29	M	R	Guitar	30	R	F3
30	M	R	Guitar	45	R	Wrist F
31	M	L	Guitar/banjo	29	R	E and abduction of 1, F2
32	M	R	Guitar/piano	28	R	F34
33	F	R	Harpsichord	32	R	E2
34	F	L	Koto	49	R	F123, radial deviation of wrist
35	M	R	Organ	75	L	F34
36	M	R	Piano	46	R	F and adduction of 1
37	M	R	Piano	59	L	E2
38	F	L	Piano	49	R	E45, ulnar deviation of wrist
39	M	L	Piano	68	R	F45
40	M	R	Piano	22	R	F2345, wrist E
41	F	L	Piano	20	R	E5, F1234
42	M	R	Piano	37	Bilateral	F345 (left), E45 (right)
43	M	R	Piano	44	Bilateral	F45(right), F45(left)
44	M	R	Piano	25	R	F and Adduction 23
45	M	R	Piano	53	L	E45, wrist F
46	M	R	Piano	38	Bilateral	E3F45(left), E2 and abduction of 5 (right)
47	M	R	Piano	24	Bilateral	F45 (left), F3 (right)
48	M	R	Piano	25	R	E2
49	M	R	Piano	25	R	E3
50	M	R	Piano	48	R	F34
51	M	R	Piano	45	R	F45
52	F	R	Piano	27	Bilateral	F34 (left), F3 (right)
53	M	R	Saxophone	32	R	F34
54	M	R	Trumpet	45	Bilateral	E3F2 (right), E4F3, incoordination
55	M	R	Trumpet	37	Bilateral	E2345 (right), E23 (left)
56	M	R	Trumpet	32	R	F3
57	F	R	Violin	24	L	F and abduction of 4, Tremor of 5
58	M	R	Violin	26	L	F45
59	F	R	Violin	35	L	F45
60	F	R	Violin	37	L	F45
61	M	R	Violin	19	R	Wrist E

Affected fingers are numbered 1 (thumb) to 5 (pinky); E, extension; F, flexion.

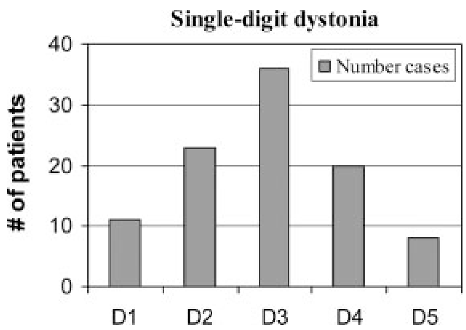

FIG. 1. In patients in whom only one finger was involved, finger 1 (D1) was involved in 11%, finger 2 (D2) in 23%, finger 3 (D3) in 37%, finger 4 (D4) in 20%, and finger 5 (D5) in 8%.

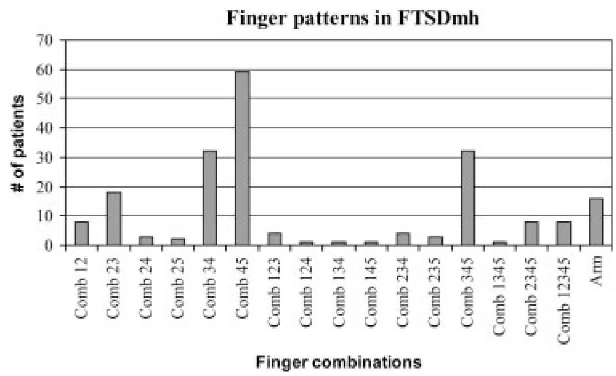

FIG. 2. Four patterns occurred with higher frequency: combinations of fingers 2, 3 occurred in 10% of cases, combination 3, 4 in 17%, combination 4, 5 in 32%, and combination 3, 4, 5 in 17%. Dystonia of nonadjacent fingers, including combinations 2,4; 2,5; 1,2,4; 1,3,4; 1,4,5; 2,3,5; and 1,3,4,5 occurred in only 6% of cases. Arm refers to dystonia of the wrist, forearm, or upper arm.

5 (17%), and combination 2, 3 (10%). Dystonia of nonadjacent fingers was much less common, occurring in only 6% of cases.

What are the Predominant Dystonic Phenotypes?

Information on the type of dystonic movement was available for 326 cases. Flexion of one or more fingers was exhibited by 177 patients (54%), extension by 41 (13%), both extension and flexion by 54 (17%), and other types of movement by 54 (17%). Each patient with bilateral hand involvement was counted once. The six patients that exhibited a discordant dystonic movement between the two hands were grouped in the category representing both extension and flexion. Figure 3 shows the type of dystonic movement segregated by instrument played. Flexion was the prevalent dystonic movement in each instrument class, occurring within a range of 25 to 76% of cases. Extension was present within a range of 4 to 22% of cases. Combined extension and flexion were present in 6 to 24% of cases. Other types of dystonic movements, not classifiable as either flexion, extension or both, were present within a range of 3 to 31% of cases.

Is There a Relationship Between the Hand Affected and Instrument Played?

Figure 4 shows the distribution of the affected side segregated by the instrument played. The right hand was predominantly affected in keyboard players (77%) and in plucked string players (78%). The left hand was predominantly affected in bowed string players (68%) and flutists (81%). Either hand was affected in all woodwinds, percussionists and brass players. Bilateral dystonia was present in 5% of cases.

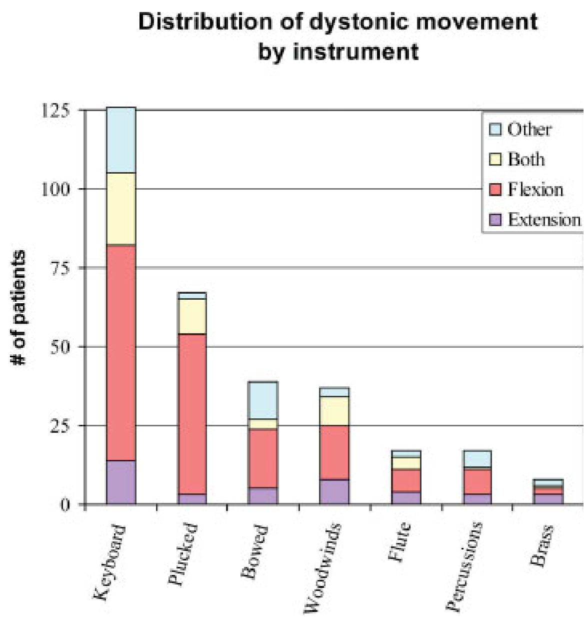

FIG. 3. Flexion was the prevalent dystonic movement in each instrument class, occurring within a range of 25–76% of cases. It was present in 54% of keyboard players, 76% of plucked string players, 46% of woodwinds players, 49% of bowed string players, 41% of flute players, 47% of percussionists, and 33% brass players. Extension was present in 7% of keyboard players, 2% of plucked string players, 22% of woodwind players, 13% of bowed string players, 23% of flute players, 18% of percussionists, and 37% of brass players. Combined extension and flexion were present in 18% of keyboard players, 16% of plucked string players, 24% of woodwind players, 8% of bowed string players, 23% of flute players, 4% of percussionists, and 12% brass players. Other types of dystonic movements, not classifiable as either flexion, extension or both, were present in 17% of keyboard players, 3% of plucked string players, 4% of woodwind players, 31% of bowed string players, 12% of flute players, 18% of percussionists, and 25% of brass players. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

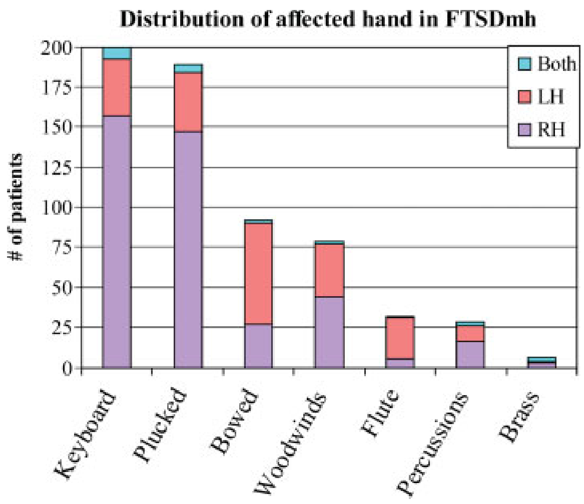

FIG. 4. The right hand was affected in 77% of keyboard players, in 78% of plucked strings players, in 29% of bowed string players, in 56% of woodwind players, in 16% of flute players, in 57% of percussionists, and in 50% of brass players. The left hand was affected in 17% of keyboard players, in 20% of plucked string players, in 68% of bowed string players, in 42% of woodwind players, in 81% of flute players, in 36% of percussionists, and in 17% of brass players. Both hands were affected in 5% of keyboard players, in 3% of plucked string players, in 2% of bowed string players, in 3% of woodwinds players, in 3% of flutists, in 7% of percussionists, and in 33% of brass players. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

Is There a Relationship Between the Dystonic Phenotype and Instrument Played?

The three most frequently occurring patterns in keyboard players (n = 106) were: combination of finger 4, 5 (33%), isolated finger 4 (19%), and finger 2 (12%); in plucked strings (n = 65) isolated finger 3 (18%), combination 3, 4, 5 (14%), and 3, 4 (11%); in bowed string players (n = 39) isolated finger 4 (21%), wrist/forearm/arm (21%), and combination 4, 5 (18%); in woodwinds (n = 38) combination 4, 5 (24%), 3, 4, 5 (18%) and isolated finger 3 (13%); in flutists (n = 17) combination 4, 5 (29%), isolated finger 3 or 4 (18% each), and combination 3, 4 (12%); in percussionists (n = 15) combination 3, 4, 5 or wrist/forearm/arm (27% each), and combination 4, 5 (13%); in brass players (n = 8) isolated finger 3 or combination 2, 3 (25% each).

DISCUSSION

In this review of almost 1,000 patients with FTSDmh, a comprehensive picture of the clinical features of the disorder emerges. Symptoms of FTSDmh typically begin in the middle of the fourth decade, and men outnumber women 4:1. The third finger is most commonly involved in single digit dystonia, and if dystonia involves multiple fingers then contiguous fingers of the ulnar side of the hand are most commonly involved. Dystonic flexion movements are common, but complex patterns of dystonia also occur. Handedness does not appear to influence the development of FTSDmh. The right hand is over-represented among keyboard and plucked string instrumentalists, and the left in bowed string players and flutists. Certain patterns of dystonic movements are associated with specific instruments.

While these data are thought-provoking, we are aware of a number of limitations that temper interpretation of these results. Attempting to define the clinical features of a disorder from pooled case series incurs many biases, such as referral bias and reporting bias to name two, and also relies heavily on the diagnostic skills of the reporting examiners. Most published series included information on instrument, gender, and affected hand, but many did not adequately detail the dystonic phenotype. These criticisms might be mitigated by several factors. Although there may be some patients who were misdiagnosed, most of the published studies originated from centers with acknowledged expertise examining musicians. Further, inclusion of series from diverse geographic locales might counteract a bias from local referral practices. In the end, the challenges of performing a detailed epidemiologic study in this patient population may leave investigators dependent on these data for some time.

The complexity of the phenotype of FTSDmh has prompted some to speculate that musicians' dystonia differs from other forms of dystonia affecting the hand. With the exception of writer's cramp, there are few series of patients with hand dystonia available for comparison. We were struck, however, by the similarities between FTSDmh and writer's cramp. The age of symptom onset among FTSDmh patients is remarkably similar to patients with writer's cramp.[21] Like writer's cramp, almost all patients with FTSDmh experience symptom onset between ages 20 and 50. Unlike writer's cramp, where as many as one-third of patients experience spread of dystonia to the other hand,[21] only 4% of FTSDmh patients experience bilateral symptoms. This may reflect the fact that many affected musicians dramatically curtail their playing within several years of the diagnosis, whereas writer's cramp patients generally continue to write (albeit with difficulty) or switch hands when one hand becomes too difficult. Although detailed clinical information was missing in most reported patients, there is a tendency particularly among pianists for the right hand to be affected first, followed by the left when dystonia spreads.

Affected musicians often ask some of the most important questions facing neurologists: Is dystonia induced through some fault in training or practice? Or was developing dystonia inevitable? Hallett and coworkers have proposed that both genetic and environmental factors are important in the development of focal dystonia (M Hallett, personal communication). Recent work supports an important genetic component in musicians' dystonia.[22,23] It is possible that the marked male predominance in reported cases of FTSDmh may represent a gender predisposition to develop dystonia. Within the last twenty years, the percentage of women in conservatories and professional orchestral positions at least equals that of men. We feel that it is thus unlikely that this overwhelming gender difference in FTSDmh results solely from over-representation of men in the profession or from reporting bias. A confounding factor is the tendency for men and women to concentrate on certain instruments (flute for women, horn for men, for example). The bilateral occurrence of dystonia in a small minority of FTSDmh patients, as in writer's cramp, supports the notion of an underlying endophenotype in these patients, with dystonia triggered by environmental exposure.

The role of environmental factors in the development of FTSDmh remains controversial. A small number of FTSDmh patients describe an acute onset of dystonia, occurring immediately after a marked increase in practice time, increase in difficulty of repertoire, marked over-practice of a particularly difficult passage, change in instrument mechanics, or even after sudden psychological or emotional stressors. However, the complexity of musical pedagogy and variation in technical approaches to instrumental performance prevent any attempt to systematically link specific instruction to the development of dystonia. Charness et al. described focal dystonic flexion of the fourth and fifth fingers in patients who were also affected with an ipsilateral ulnar neuropathy. The course of dystonic symptoms improved with surgical treatment of the neuropathy, and worsened when the entrapment recurred.[15] Byl and Topp's primate model of focal dystonia serendipitously demonstrated rapid development of dystonia in one animal with an anatomical restriction in an affected tendon.[24] In clinical practice however, most patients with FTSDmh lack obvious environmental triggers, and symptoms develop insidiously over weeks to months. Examining the distribution of affected hands and technical demands of performance (see Fig. 4), it appears that the hand subject to the greater technical burden is preferentially affected by dystonia. In the keyboard repertoire, the right hand usually carries the melodic line and sustains a greater technical burden than the left hand. Among plucked string instruments, the right, plucking hand bears the greater burden. In both keyboard and plucked string instrumentalists, the right hand is overwhelmingly affected by FTSDmh. Among string instrument players, the left hand, and particularly fingers 2 to 5, bears the greater technical burden; string players are preferentially affected by FTSDmh on the left. The overwhelming preference for left hand involvement in flutists is surprising, given the fact that the hands perform very similar tasks. However, it may be that the demands placed on the left index finger, to support the instrument and negotiate the key, contribute to this finding. The number of affected woodwind and brass players is probably too small to draw clear conclusions about hand susceptibility. It is not possible to estimate the rate of development of dystonia for each instrument-although more pianists have been reported than string players, this may be due to the fact that more people begin keyboard instruction.

One of the most intriguing features of FTSDmh is the variability and complexity of the various dystonic phenotypes. Once established the dystonic pattern rarely changes in a given patient, although dystonia may be triggered more easily or even occur at rest. While many different patterns of dystonia can be seen in a given instrument, there are also clear predilections among certain instruments for certain patterns of dystonic movements. Of interest, these dystonic patterns may affect the wrist preferentially, as seen in the video accompanying this paper. Among guitarists and pianists, flexion of the right third through fifth fingers is a frequent pattern, while flexion of the left fourth and fifth fingers is common in string players. Recent studies using magnetoencephalography, evoked potentials and functional imaging have demonstrated cortical and subcortical abnormalities in the homuncular representation of the fingers in patients with FTSDmh.[25–27] It appears that FTSDmh almost always affects adjacent digits (see Fig. 2), perhaps reflecting adjacent progression in abnormalities of somatotopy. Notable in their absence from the literature are reports of double bassists with left hand dystonia. We suggest the possibility that the wider spacing of the notes, and the resulting lack of simultaneous finger action, might protect against the development of dystonia.

We were struck by the overwhelming predilection of the fourth and fifth fingers in FTSDmh (see Fig. 2), and wish to suggest a possible explanation for this unusual finding. Among keyboard players, the right fourth and fifth fingers bear a special responsibility, often articulating the melodic line while the remainder of the right hand attends to other duties. Among string players, the left fourth and fifth fingers perform work at least equal to that of the index and middle finger, despite the fact that these fingers are physically weaker. Wilson has put forth a compelling argument that cultural and social pressures changed for musicians in the nineteenth century, as the idea of the performing virtuoso was born and public performances occurred in larger halls with increasingly demanding repertoire.[28] These challenges placed an increasing burden on the musicians' hand. However, it is the median-innervated muscles of the hand that were designed for such precision activity, an idea first put forth by Napier.[29] The ulnar hand may have been subjected to performance demands for which it was not designed. Is it possible then that the 20th century epidemic of FTSDmh and the predominance of FTSDmh of the ulnar hand represent a cost of such selection pressures to produce such "musical thoroughbreds?"[28]

We hope that the picture of FTSDmh derived from this review will be useful to neurologists who encounter these patients in clinical practice. The diagnosis of dystonia is a watershed event in the life of a professional musician, frequently occurring after months or years of suffering in silence. While one might argue that early diagnosis is not critical in a disorder that typically does not remit and in which treatment is symptomatic, in our experience establishing the correct diagnosis is often a profound relief for patients. Besides validating the symptoms that patients endure, proper diagnosis also allows patients to access benefits and disability compensation, learn that their condition is becoming more understood, and that there are acceptable new ways of dealing with it.

LEGEND TO THE VIDEO

The videotape accompanying this paper presents 13 musicians with FTSDmh. The first 5 patients illustrate the complexity of the dystonic phenotype. The first violinist is affected with dystonic flexion of the fourth and fifth finger, triggered by fingering with the third or fourth finger. The next violinist has isolated dystonia of the left fourth finger, with flexion and external rotation of the base of the finger, pulling the fingertip off of the string. Next, a flutist with isolated dystonic extension of the left third finger; the finger slides off the key, opening the hole and disrupting the sound. The fourth patient, a bagpipe player with an ipsilateral traumatic ulnar neuropathy, is afflicted with mild dystonic flexion of the left fourth and fifth finger. This produces a delay in covering the holes of the instrument, and alters the rhythm of his tune. The fifth patient performs on a custom-made banjo-guitar hybrid. His complex dystonia involves the thumb and index finger, causing him to miss plucking the strings and to occasionally hit the wrong string. Dystonia of the thumb and index finger is typical in banjo players, while guitarists are usually afflicted with dystonia of the third through fifth digits (described below).

The sixth patient is a flutist whose dystonia of the left hand causes slowness and incoordination during certain trills. The left pinky extends and abducts abnormally during this maneuver. His dystonia is bilateral, with trills of the right hand also involved. The next patient is a trumpeter who developed dystonia of his right, fingering hand. He switched to using his left hand to depress the keys, only to develop a different dystonic pattern eight months later, a dramatic example of an endophenotypic predisposition to develop dystonia. The following violinist has a complex dystonia affecting his bowing hand. As soon as he holds the bow in a preparatory posture, involuntary pronation and wrist flexion interfere with his bow stroke. These movements are also triggered by demonstrating using a pen as a bow, but are not triggered when he places his hand on top of the examiner's hand holding the bow.

The final 5 patients illustrate the resilience and cleverness of the compensation and treatment strategies that patients employ. The first patient in this group is a tabla player, with ulnar deviation of the right wrist. He supports his affected right arm with his leg, employing a sensory trick, with mild improvement in dystonia. The next patient is a guitarist with subtle dystonic flexion of the right third through fifth fingers. He has compensated for the incoordination of his hand by refingering the guitar literature to play with only his unaffected thumb and index finger, a heroic feat. The next performer is a clarinetist affected by a complex dystonia of the right wrist and fingers. While teaching a lesson, he serendipitously discovered a sensory trick–holding a pencil between certain fingers of his right hand markedly improved the dystonic movements. Varying the width of the pencil and placing it between alternate fingers immediately abolished this benefit. The next patient is a guitarist who built an unusual pick to take advantage of his sensory trick. His dystonia causes flexion of the right third through fifth fingers, yet when he is allowed to rest the base of the pick on his right third finger, he is able to play without activation of abnormal flexion movements of the fingers. The last patient is a guitarist with a classic pattern of dystonic flexion of 3 to 5. Although treatment with botulinum toxin is not within the scope of this article, we include this segment before and after injection to demonstrate that treatment can have great meaning for the listener and for the performer.

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