



## PASIG MONTHLY CITATION BLAST: No.14

September 2006

Dear PASIG members:

I've just returned from the PASIG-sponsored *Emergency Response for the Performing Artist* course, taught by our own Tara Jo Manal and Laura Schmidt. Every one of us needs this course! The experience was incredibly valuable and I plan to return in three years for re-certification. Thanks Tara Jo and Laura!

This month's Citation BLAST continues our special topic series: *focal dystonia* contributed by one of our student members, Yuriko Nabeta (Hunter College, CUNY). The format is an annotated bibliography of articles on the selected topic from 1996–2006. Special topics will be targeted periodically throughout the year. If you'd like to suggest a topic or create one, please let me know.

As a reminder, each month's citations will be added to specific EndNote libraries: 1) Ice Skating, 2) Gymnastics, 3) Music, and 4) Dance. This particular topic, which is most relevant to the musician, will be added to the Music library. The updated libraries will, in turn, be posted on the PASIG webpage for our members to access and download. (Information about EndNote referencing software can be found at <http://www.endnote.com>, including a 30-day free trial).

We're excited to report that performing arts-related CSM 2007 abstract submissions increased again this year. Don't forget, the PASIG sponsors an annual student research scholarship. This award is to recognize students, who have had an abstract accepted to CSM, for their contribution to performing arts research. For more information on the research award please check our webpage ([www.orthopt.org/sig\\_pa.php](http://www.orthopt.org/sig_pa.php)).

As always, your comments and entry contributions to these Citation BLASTs are always welcome. Please drop me an e-mail anytime.

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## **SPECIAL TOPIC: FOCAL DYSTONIA**

For medical professionals including physical therapists, focal dystonia has been difficult to diagnosis and treat due to its debatable etiology. Focal dystonia is a debilitating professional disorder in musicians that can decrease their performance levels and may lead to the end of their career. Instrumentalists with this disorder are unable to coordinate the movements and control muscle contractions in the affected areas often involving arms, hands or mouth. Although its etiology is still debated, focal dystonia has been found to result from several origins. The purpose of this annotated bibliography is to help physical therapists obtain insight on focal dystonia and answer questions such as: What are the possible origins of the disorder and effective treatments that have been supported by current research? I hope this will be a helpful resource for you.

Yuriko Nabeto SPT

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Ackermann BJ, Adams R (2005). Finger movement discrimination in focal hand dystonia: Case study of a cellist. Med Probl Perform Artists 20(2): 77-81.

Focal hand dystonia in musicians has received increasing attention in recent years due to the debilitating and career threatening nature of this condition. In cellists, focal hand dystonia is reported only infrequently in the existing literature, as compared to the rate in other instrumentalists, such as pianists and violinists. Although relatively less common, it has similarly devastating effects for those with this disorder. In the pilot study presented here, a 47-year-old male professional cellist experiencing left focal hand dystonia underwent pretests and posttests when he attended a 10-day period of intensive sensorimotor retraining. To monitor the effects of treatment, a pseudo-cello was designed that used the principles of psychophysical methodology to test active finger movement discrimination. This test was designed to evaluate whether this cellist could perceive the relative position of his left fingers in as task-specific a manner as possible. The pseudo-cello results showed a reduced ability to discriminate the height and tension of a string in the fingers most affected by the dystonia. Following the 10-day period of intensive physiotherapy, discrimination of finger movements had improved in the fingers that had been worked on with the rehabilitation program, and this corresponded with an improvement in the dystonia rating scale. The positive results obtained here suggest that this form of testing in focal hand dystonia warrants further research.

Blake DT, Byl NN, et al. (2002). Sensory representation abnormalities that parallel focal hand dystonia in a primate model. Somatosens Mot Res 19(4): 347-57.

In our hypothesis of focal dystonia, attended repetitive behaviors generate aberrant sensory representations. Those aberrant representations interfere with motor control. Abnormal motor control strengthens sensory abnormalities. The positive feedback loop reinforces the dystonic condition. Previous studies of primates with focal hand dystonia have demonstrated

multi-digit or hairy-glabrous responses at single sites in area 3b, receptive fields that average ten times larger than normal, and high receptive field overlap as a function of horizontal distance. In this study, we strengthen and elaborate these findings. One animal was implanted with an array of microelectrodes that spanned the border between the face and digits. After the animal developed hand dystonia, responses in the initial hand representation increasingly responded to low threshold stimulation of the face in a columnar substitution. The hand-face border that is normally sharp became patchy and smeared over 1 mm of cortex within 6 weeks. Two more trained animals developed a focal hand dystonia variable in severity across the hand. Receptive field size, presence of multi-digit or hairy-glabrous receptive fields, and columnar overlap covaried with the animal's ability to use specific digits. A fourth animal performed the same behaviors without developing dystonia. Many of its physiological measures were similar to the dystonic animals, but receptive field overlap functions were minimally abnormal, and no sites shared response properties that are normally segregated such as hairy-glabrous combined fields, or multi-digit fields. Thalamic mapping demonstrated proportionate levels of abnormality in thalamic representations as were found in cortical representations.

Byl NN (2003). What can we learn from animal models of focal hand dystonia? Rev Neurol 159(10 Pt 1): 857-73.

Focal hand dystonia (FHD) is a disabling disorder of hand control characterized by a loss of inhibition and involuntary co-contractions of agonists and antagonists that can develop in motivated, productive individuals performing highly repetitive, intensive hand tasks. It is our hypothesis that FHD can result from aberrant learning. We summarize three behavioral animal models (Nancy-mae aotus owl monkeys and Sprague Dawley rats) that provide evidence supporting aberrant learning as one origin of FHD. Hand task behaviors that increase the risk for repetitive strain injury-FHD include: attended, precise, repetitive behaviors that involve near coincident inputs-outputs (e.g. rapid reversal of agonists-antagonists, stereotypical movements, stressful end range motions, cutaneous stimulation across broad surfaces). High force, vibration, congenital abnormalities, and stress can further increase the risk. The central consequences of aberrant learning include large sensory receptive fields (rfs), significant overlap of rfs across adjacent digits and across glabrous and dorsal surfaces, and the persistence of digital representations across a broad cortical distance (>600 microm). Behavioral animal models are valid for the study of FHD etiology and could logically be applied to study the effects of pharmaceutical, surgical, anatomical, and behavioral enrichment intervention strategies, but these models may have limitations in the study of the recovery of fine motor, articulated, interdigitated movements following progressive, learning based, complex sensorimotor training.

Byl NN (2004). Focal hand dystonia may result from aberrant neuroplasticity. Adv Neurol 94: 19-28.

Byl NN, McKenzie A (2000). Treatment effectiveness for patients with a history of repetitive hand use and focal hand dystonia: A planned, prospective follow-up study. J Hand Ther 13(4): 289-301.

Recent studies show that rapid, nearly simultaneous, stereotypical repetitive fine motor movements can degrade the sensory representation of the hand and lead to a loss of normal motor control with a target task, referred to as occupational hand cramps or focal hand dystonia. The purpose of this prospective follow-up study was to determine whether symptomatic patients in jobs demanding high levels of repetition could be relieved of awkward, involuntary hand movements following sensory discriminative retraining

complemented by a home program of sensory exercises, plus traditional posture, relaxation, mobilization, and fitness exercises. Twelve patients participated in the study. They all had occupational hand cramps, as diagnosed by a neurologist. Each patient was evaluated by a trained, independent research assistant before treatment and three to six months after treatment, by use of a battery of sensory, motor, physical, and functional performance tests. Care was provided by a physical therapist or a supervised physical therapist student in an outpatient clinic. Patients were asked to stop performing the target task and to come once a week for supervised treatment that included 1) heavy schedules of sensory training with and without biofeedback to restore the sensory representation of the hand, and 2) instructions in stress-free hand use, mirror imagery, mental rehearsal, and mental practice techniques designed to stop the abnormal movements and facilitate normal hand control. Patients were instructed in therapeutic exercises to be performed in the home to improve postural alignment, reduce neural tension, facilitate relaxation, and promote cardiopulmonary fitness. Following the defined treatment period, all patients were independent in activities of daily living, and all but one patient returned to work. Significant gains were documented in motor control, motor accuracy; sensory discrimination, and physical performance (range of motion, strength, posture, and balance). This descriptive study that includes patients with occupation-related focal hand dystonia provides evidence that aggressive sensory discriminative training complemented by traditional fitness exercises to facilitate musculoskeletal health can improve sensory processing and motor control of the hand.

Byl NN, McKenzie A, et al. (2000). Differences in somatosensory hand organization in a healthy flutist and a flutist with focal hand dystonia: A case report. J Hand Ther 13(4): 302-9.

Focal hand dystonia is a disabling, involuntary disorder of movement that can disrupt a successful musician's career. This problem is difficult to treat, to some extent because we do not fully understand its origin. Somatosensory degradation has been proposed as one etiology. The purpose of this case study was to compare the differences in the somatosensory hand representation of two female flutists, one with focal dystonia of the left hand (digits 4 and 5) and one a healthy subject (the control). Noninvasive magnetic source imaging was performed on both subjects. The somatosensory evoked potentials of controlled taps to the fingers were measured with a 37-channel biomagnetometer and reported in terms of the neuronal organization, latency, amplitude, density, location, and spread of the digits on each axis (x, y, and z). The somatosensory representation of the involved hand of the flutist with dystonia differed from that of the healthy flutist. The magnetic fields evoked from the primary somatosensory cortex had a disorganized pattern of firing, with a short latency and excessive amplitude in the involved digits of the affected hand, as well as inconsistency (decreased density). In addition, the patterns of firing were different in terms of the location of the digits on the x, y, and z axes and sequential organization of the digits. This study confirms that somatosensory evoked magnetic fields can be used to describe the representation of the hand on the somatosensory cortex in area 3b. Degradation in the hand representation of the flutist with focal hand dystonia was evident, compared with the hand representation of the healthy flutist. It is not clear whether the sensory degradation was the cause or the consequence of the dystonia. The questions are whether re-differentiation of the representation could be achieved with aggressive sensory retraining and whether improvement in structure would be correlated with improvement in function.

Byl NN, Nagajaran SS, et al. (2003). Effect of sensory discrimination training on structure and function in patients with focal hand dystonia: a case series. Arch Phys Med Rehabil 84(10): 1505-14.

**OBJECTIVE:** To measure the effects of sensorimotor training based on the principles of neuroplasticity for patients with focal hand dystonia. **DESIGN:** Case series of 3 subjects with focal hand dystonia of the left hand, compared with age-matched normative controls. **SETTING:** Outpatient clinic. **PARTICIPANTS:** Three consecutive clinic patients-musicians with focal hand dystonia-who described a history of repetitive practice and performance (2 women; ages, 23 y and 35 y; 1 man; age, 24 y). **INTERVENTION:** Subjects were asked to stop performing the tasks that caused the abnormal movements, to participate in a wellness program (aerobics, postural exercises, stress free hand use), and to carry out supervised, attended, individualized, repetitive sensorimotor training activities at least once week for 12 weeks and reinforced daily at home. **MAIN OUTCOME MEASURES:** Standard tests documenting somatosensory hand representation, target-specific hand control, and clinical function. **RESULTS:** On the affected side, the 3 subjects improved an average of 86.8% on somatosensory hand representation, 117% on target-specific performance, 23.9% on fine motor skills, 22.7% on sensory discrimination, 31.9% on musculoskeletal skills, and 32.3% on independence. All 3 subjects improved 10% or more on 90% of the subtests with 20% improvement on 50% of the subtests. **CONCLUSION:** Individuals with focal hand dystonia who have a history of repetitive hand use can improve cortical somatosensory responses and clinical motor function after individualized sensorimotor training consistent with the principles of neural adaptation.

Candia V, Rosset-Llobet J, et al. (2005). Changing the brain through therapy for musicians' hand dystonia. Annals NY Academy Sci 1060: 335-342.

Focal hand dystonia is a disorder in which sensory and motor anomalies emerge that appear to be grounded in maladaptive routes of cortical plasticity. Remodeling cortical networks through sensory-motor retuning (SMR), we achieved long-term reduction in the symptoms of focal hand dystonia. Magnetoencephalography confirmed that SMR modified the representational cortex of the fingers, whereby the representation of the affected hand was reorganized so that it resembled more the organization of the non-affected side. Furthermore, we observed differences in abnormal tactile acuity between patients with musician's cramp and those with writer's cramp: Using two-point finger discrimination, dystonic musicians showed perceptual asymmetry between hands, while writer's cramp patients did not. To further evaluate the occurrence of collateral disturbances in focal dystonia, we assessed the clinical histories of 101 affected musicians. An important finding from this study was that dystonic musicians who play a similar first and second instrument reported a continuous worsening of their symptoms. In addition, collateral disturbances appeared with a shorter delay when more than one instrument was played. Taken together, these studies suggest that (1) neurological dysfunction can be reversed by context-specific training protocols, (2) specific symptomatic and etiological differences among various forms of focal hand dystonia might result from different behavioral experiences and their central representation, and (3) the spread of symptoms might be prevented by avoiding training that implies movement patterns similar to the main affected task, and by reducing the amount of task-associated movement behavior.

Chamagne P (2003). Functional dystonia in musicians: rehabilitation. Hand Clin 19(2): 309-16.

For functional dystonia in musicians, rehabilitation should be principally psychomotor, including psychotherapy based on analysis of the personality and a global physical education of the corporal scheme--it is a compartmental reeducation. From the time of onset, it is of great importance to the musician that the mechanism at the origin of the problem be understood and analyzed. For the therapist, the principal goal is to identify the multiple compensations that mask the real dysfunction. When the musician and the therapist

agree on the real cause of the dystonia, it becomes evident that an anatomopathologic explanation using simple vocabulary is as efficacious in the treatment as is the physical therapy. Beginning to rectify abnormal postures and reeducation of the impaired motions then can begin with a whole range of techniques, using specific exercises, stretching, and removable orthoses..

Hirata Y, Schulz M, et al. (2004). Sensory mapping of lip representation in brass musicians with embouchure dystonia. Neuroreport 15(5): 815-8.

Embouchure dystonia is a focal task-specific disorder involving abnormal non-coordinated movements and involuntary muscle contraction around the mouth. In professional brass players it is often so disabling that patients have to limit or give up their occupation. We examined the somatosensory homuncular representation and measured gap detection sensitivity of the lips in eight former professional musicians affected by embouchure dystonia and eight control subjects. Relative to controls, the patients' digit, and especially the thumb, representations were shifted in a lateral direction towards the lip representational zone. Patients' upper lips showed decreased sensitivity compared to their lower lips ( $p < 0.01$ ). This asymmetry result was absent in controls. Abnormal somatosensory reorganization may contribute to the disorder.

Iltis PW, Givens MW (2005). EMG characterization of embouchure muscle activity: reliability and application to embouchure dystonia. Med Probl Perform Artists 20(1): 25-34.

The purpose of the study was to develop a method to quantitatively and qualitatively describe the activity of selected muscles of the embouchure in French horn players using surface electromyography (EMG). Also, the reliability of several dependent variables that may be useful in future studies of embouchure dystonia (ED) was assessed. Five volunteers, including four normal French hornists (two male, two female) and one performer with ED performed two standardized tasks on two different occasions. The first task consisted of playing four iterations of two notes, one that elicited tremor in the ED subject and one that did not. This was followed by a 60-sec fatigue trial on the nontremor note. The levator labii and depressor anguli oris muscles were instrumented with miniature surface electrodes, and a microphone within a mute allowed audio signals from the horn to be simultaneously recorded. The presence of tremor was uniquely identified in the ED subject using EMG, and continuous wavelet transformation scalogram comparisons indicated temporal differences in signal power ( $[\mu\text{V}^2/\text{Hz}]$ ) as well as in the dominant frequency range. Within-trial reliability for amplitude, mean and median frequency, zero crossings, and power was excellent ( $r \geq 0.977$ ) for both muscles on the first performance task. Between-session reliability ranged from fair to good ( $r = 0.677$  [inverted question mark]  $0.898$ ) on these same variables. Numerous other variables associated with the fatigue task also showed good to high reliability ( $r = 0.90$  [inverted question mark]  $0.99$ ) between testing sessions. The findings suggest that the simple testing protocol presented may be of use in future studies of ED.

Jabusch HC, Vauth H, et al. (2004). Quantification of focal dystonia in pianists using scale analysis. Mov Disord 19(2): 171-80.

Focal dystonia in pianists is a task-specific movement disorder that causes loss of pianistic skills and provokes irregularities in playing. So far, no method has been available for objective quantification of the disorder. Eight professional pianists with focal dystonia and eight healthy professional pianists matched by age, gender, and handedness were examined, using a newly developed MIDI-based Scale Analysis as well as the Arm Dystonia Disability Scale (ADDS). Key velocities and timing parameters were analyzed. In 5 pianists

with dystonia, follow-up examinations were carried out after treatment with botulinum toxin-A. In affected hands, significantly higher mean standard deviations of timing parameters were seen compared with healthy reference hands. After treatment with botulinum toxin-A, significant improvements in performance parameters were monitored by Scale Analysis. Mean standard deviations of inter-onset intervals correlated with ADDS scores. We conclude that Scale Analysis is an effective and precise tool for quantification of focal dystonia in pianists and provides fine resolution. It is independent of rating methods and allows reliable follow-up examinations during treatment.

Jabusch HC, Zschucke D, et al. (2005). Focal dystonia in musicians: Treatment strategies and long-term outcome in 144 patients. *Mov Disord* 20(12): 1623-6.

We present the long-term outcome of 144 musicians with focal dystonia after treatment with botulinum toxin (n = 71), trihexiphenidyl (n = 69), pedagogical retraining (n = 24), ergonomic changes (n = 51), or nonspecific exercises on the instrument (n = 78). Outcome was assessed by patients' subjective rating of cumulative treatment response and response to individual therapies. Seventy-seven patients (54%) reported an alleviation of symptoms: 33% of the patients with trihexiphenidyl, 49% with botulinum toxin, 50% with pedagogical retraining, 56% with unmonitored technical exercises, and 63% with ergonomic changes.

Lederman RJ (2004). Drummers' dystonia. *Med Probl Perform Artists* 19(2): 70-4.

Several reviews involving large numbers of instrumental musicians with focal dystonia from centers in the United States and Europe are available in the performing arts medicine literature, but only a relatively few percussionists have been included. This article describes 6 percussion instrumentalists, out of a total of 139 musicians with dystonia, seen in the Cleveland Clinic Medical Center for Performing Artists. The five men and one woman ranged in age from 21 to 51 years at the onset of dystonia; four were playing professionally, and two were students. Duration of symptoms at the time of evaluation ranged from 1 to 10 years, although five of six were seen 3 years or less after onset. Three were primarily classical percussionists, two played mainly jazz or rock, and one played country music. Two of the six were left-handed; dystonia affected the right arm in three, the left in two, and the left more than the right in one. The nondominant limb was affected solely or predominantly in five of six. Dystonia affected primarily the forearm and wrist, rather than the digits, in contrast to most keyboard, string, and woodwind instrumentalists, presumably reflecting the relative stresses of repetitive movements in this group. A variety of treatment modalities were used before and after evaluation. Of the three musicians still actively playing, one uses anticholinergic medication before each performance, one has restricted her playing to mallet instruments, and one has had a favorable response to limb immobilization. Two others remain in music, teaching or conducting; one has been lost to follow-up.

Lim VK, JL Bradshaw JL, et al. (2004). Abnormal sensorimotor processing in pianists with focal dystonia. *Adv Neurol* 94: 267-73.

Focal dystonia is a task-specific sensorimotor disorder that is characterized by sustained muscle contractions, which may cause twisting, repetitive movements, or abnormal postures. In the current study, the contingent negative variation was recorded in a group of professional pianists with focal dystonia (musicians' cramp) and compared to pianist controls. The CNV is composed of an early stimulus processing component and a later response preparation component. The CNV can be elicited in tasks that require movement and nonmovement. A subtractive analysis with a nonmovement condition was used to minimize effects of the CNV not related to response preparation. The current results revealed no group differences for the early CNV (processing of stimulus properties). In

contrast, a significant group difference was found in the late CNV (movement preparation) between patients and controls, with the patients showing significantly higher activation prior to movement. The current study demonstrates an increase in overall sensorimotor activity prior to movement in patients with musicians' cramp. This overexcitation of the cortex may be the result of a dysfunction in the globus pallidus, resulting in a lack of inhibition and/or an increase in excitation.

McKenzie AL, Nagarajan SS, et al. (2003). Somatosensory representation of the digits and clinical performance in patients with focal hand dystonia. Am J Phys Med Rehabil 82(10): 737-49.

**OBJECTIVE:** The purpose of this study was to incorporate magneto-encephalography and clinical testing to describe differences in somatosensory organization and sensorimotor function of the hand in patients with focal hand dystonia, a target-specific disorder of voluntary movement that interferes with fine motor control during the performance of rapid, repetitive, skilled movements. **DESIGN:** This descriptive study included prospective, quasi-experimental comparisons between groups. **RESULTS:** Patients with focal hand dystonia demonstrated deficits in physical variables, sensory processing, and motor control when compared with age- and sex-matched controls. They also had altered patterns of firing (amplitude and latency integrated over time) and abnormal somatosensory representations on magnetoencephalography. **CONCLUSIONS:** These study findings suggest that there are alterations in both somatosensory representation of the digits and clinical performance in patients with focal hand dystonia. Future studies to determine if alterations in the sensorimotor feedback loop contribute to the development of focal hand dystonia are indicated. If so, intervention strategies may need to include specific types of somatosensory retraining as part of the rehabilitation program for patients with focal hand dystonia.

Rodríguez AV, Kooh M, et al. (2005). Musician's cramp: a case report and literature review. J Clin Rheum: Practical Reports On Rheumatic & Musculoskeletal Diseases 11(5): 274-276.

Musician's focal dystonia is a motor dysfunction that appears in artists after years of repetitive and fine movements during performance. This is the condition most feared by musicians because it leads to difficulties in controlling movements, which can interrupt or terminate their careers. It is characterized by the onset of involuntary muscle contractions and movements; its distinguishing feature is that it only occurs during a specific and well-defined action. It is rarely diagnosed because those who experience it do not seek medical attention for fear or shame, but also because many physicians do not consider the disease in the differential diagnosis of motor dysfunction. We describe the case of a guitarist who presented to our outpatient clinic after many years of experiencing musician's focal dystonia. He reported a long list of misdiagnoses and a variety of unsuccessful treatments. Musician's focal dystonia is an under-diagnosed condition. Treatment benefit is limited despite recent innovative approaches. Rheumatologist should be aware of this condition.

Rosenkranz K, Altenmüller E, et al. (2000). Alteration of sensorimotor integration in musician's cramp: impaired focusing of proprioception. Clin Neurophysiology 111(11): 2040-2045.

**OBJECTIVE:** The influence of muscle vibration (MV) as a strong proprioceptive input on motorcortical excitability was studied in 5 patients with musician's cramp, 5 musician controls and 5 non-musician controls. **METHODS:** The relaxed flexor carpi radialis (FCR), involved in the dystonic movement in all patients, was vibrated using low frequency (80 Hz) and low amplitude (0.5 mm). Transcranial magnetic stimulation (TMS; intensity, 120% of motor threshold) was applied without MV, 3 and 9 s after the onset of MV. Motor-evoked potentials (MEPs) in the FCR and in the antagonistic extensor carpi radialis (ECR) were recorded.



RESULTS: With MV, musician and non-musician controls showed a facilitation of MEPs in the FCR and a decrease of MEPs in the ECR. In musician's cramp, both phenomena were significantly less pronounced. CONCLUSIONS: The reduced facilitation of MEPs in musician's cramp indicates a reduced MV-induced activation of motorcortical areas representing the FCR. The less pronounced inhibition by MV reflects a reduced inhibitory control of the antagonistic ECR. As there were no differences between musician and non-musician controls, the observed changes in musician's cramp refer to this special form of focal dystonia. An impairment of focused motorcortical activation by proprioceptive input from a muscle involved in the dystonic movement is suggested.

Schuele S, Jabusch HC, et al. (2005). Botulinum toxin injections in the treatment of musician's dystonia. Neurology 64(2): 341-3.

The authors present the results of 84 musicians with focal task-specific dystonia treated with EMG-guided botulinum toxin injections. Treatment outcome was assessed by subjective estimation of playing before and after treatment and self-rating of treatment response. Fifty-eight (69%) of the musicians experienced improvement from the injections and 30 of 84 musicians (36%) reported long-term benefit in their performance ability.

Schuele S, Lederman RJ (2004). Long-term outcome of focal dystonia in string instrumentalists. Movement Disorders 19(1): 43-48.

This study describes the clinical characteristics and long-term outcome in string instrumentalists with focal task-specific dystonia. We present the results of a follow-up telephone survey of 21 violin and viola players with focal dystonia. Eighteen musicians responded to the questionnaire. Information on long-term outcome was available on average 13.8 years after onset of symptoms. Main complaints were playing-related loss of control and involuntary movements affecting the fingering hand in 16 and the bow arm in 5 patients. In 18 patients (86%), signs of abnormal posture could be detected by watching them play their instrument. Treatment attempts included nerve decompression, physical therapy, retraining, and anticholinergic medication. In selected patients, botulinum toxin injections or splint devices were offered. Only 38% of the performing artists were able to maintain their professional careers, among them none with bow arm dystonia. Focal dystonia may affect the fingering hand or bow arm in violin and viola instrumentalists. Treatment benefit is limited and in more than half of the patients, dystonia leads to the end of their musical career.

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