



# Overflow, contralateral, and mirror hand dystonia

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## ABSTRACT

**OBJECTIVE:** To characterize writing-induced overflow and contralateral hand dystonia. **BACKGROUND:** Motor overflow is an involuntary muscle contraction with or without associated movement which accompanies voluntary movements, typically observed in patients with focal dystonia. Contralateral dystonia refers to a dystonic movement or posture that is induced by a specific task, such as writing, performed by the contralateral normal body part. Mirror dystonia is an abnormal movement or posture that is phenomenologically identical or similar ("mirror") to the dystonia in the opposite dystonic body part. The relationship, if any, between overflow, contralateral, and mirror dystonia has not been fully explored. **METHODS:** Patients with hand dystonia referred to the Baylor College of Medicine Movement Disorders Clinic underwent detailed neurological assessment and were videotaped according to a pre-specified protocol, approved by the Institutional Review Board. The videotapes were reviewed for any evidence of overflow, contralateral or mirror dystonia. **RESULTS:** All our seven patients, mean age 48.4 (40 - 54) years, had typical focal dystonia with mean age at onset of dystonia at 43.6 (29 - 50) years. Only one patient reported family history of dystonia and none had a history of trauma or exposure to dopamine receptor blocking drugs. Of the seven patients, three had task-specific simple WC and four had focal hand dystonia. Six patients demonstrated contralateral dystonia; four had hyperextension of fingers, most commonly second and third fingers, two had dystonic involvement of wrists while writing with the dominant hand, but writing with the non-dominant hand induced the similar dystonic movement and posture in the opposite hand. Three patients had the ipsilateral overflow movements with contraction of bicep brachii and pectoralis major muscles. One patient had contralateral overflow movements with the right thumb abduction, and another had an eversion of the right wrist. One patient demonstrated mirror movements while performing wrist flexion-extension, pronation-supination, and hand gripping. **CONCLUSION:** In patients with focal dystonia, a specific activity, such as writing, of the dystonic limb may induce overflow movements in the adjacent body parts (overflow dystonia) and voluntary movement of a normal body part may induce or exacerbate dystonia in the opposite body part (contralateral dystonia). Mirror dystonia, the same or similar ("mirror") movement or posture as that of contralateral dystonic limb, is actually rare and the cases of mirror dystonia reported in the literature probably represent overflow or contralateral dystonia, which are may be pathogenically related but different from true mirror dystonia

## INTRODUCTION

Limb dystonia is characterized by involuntary, repetitive muscle contractions leading to abnormal limb movement and posture often interfering with motor performance. Task-specific hand dystonia has been classified according to specific impairment of particular function, such as writer's cramp (WC), musician's cramp, and other occupational cramps. [Hallett, 2006] Writer's cramp (WC) and other task-specific movement disorders usually occur at onset of a performance of a specific task, but in some patients the specificity is subsequently lost and as the dystonia worsens it may also occur with other tasks, spreads to other anatomical areas, and may even occur at rest. Writer's cramp has been classified as simple WC (occurring only during writing) and complex WC (dystonia present during activities other than writing). [Jedynak et al., 2001] In our population of patients with focal dystonia we have observed four different patterns of abnormal muscle activity:

1. **Ipsilateral overflow** : an involuntary contraction of muscles adjacent to those involved in the focal dystonia;
2. **Contralateral overflow** : an involuntary movement or dystonic posture in the contralateral limb during a voluntary movement of normal or dystonic limb;
3. **Contralateral dystonia** : a dystonic movement or posture in the homologous body part that is induced by a specific task, such as writing, performed by the contralateral normal body part; and
4. **Mirror movement** : an involuntary movement or a posture that is phenomenologically identical or similar to voluntary movement in the opposite body part.

We describe seven patients with focal hand dystonia assessed by a protocol designed to characterize these various patterns.

## METHODS

Seven patients with hand dystonia referred to the Baylor College of Medicine Movement Disorders Clinic underwent detailed neurological assessment and were videotaped according to a pre-specified protocol and after they signed informed consent approved by the Institutional Review Board. The videotapes were subsequently reviewed for evidence of overflow, contralateral or mirror dystonia.

## RESULTS

All our seven patients, mean age 48.4 (40 - 54) years, had typical focal dystonia with mean age at onset of dystonia at 43.6 (29 - 50) years. (Table 1) Only one patient reported family history of dystonia and none had a history of trauma or exposure to dopamine receptor blocking drugs. Of the seven patients, three had task-specific simple WC and four had focal hand dystonia. Six patients demonstrated contralateral dystonia; four had hyperextension of fingers, most commonly second and third fingers, two had dystonic involvement of wrists while writing with the dominant hand, but writing with the non-dominant hand induced the similar dystonic movement and posture in the opposite hand. Three patients had the ipsilateral overflow movements with contraction of bicep brachii and pectoralis major muscles. One patient had contralateral overflow movements with the right thumb abduction, and another had an eversion of the right wrist. One patient demonstrated mirror movements while performing wrist flexion - extension, pronation - supination, and hand gripping. (Table 2)

Table 1: Demographic Characteristics

Case	Age (yr)	Sex	Race	Handed	Occupation	Age at onset	Duration	Family history	Trauma
1	40	F	A	right	Banker	39	1 yr.	No	No
2	53	F	C	right	Nurse	50	3 yr.	No	No
3	44	F	C	right	Attorney	29	15 yr.	No	No
4	54	F	C	right	Delivery	50	4 yr.	Yes, son	No
5	51	F	C	right	Office manager	50	10 mo.s	No	No
6	47	F	C	right	Administrator	37	10 yr.	No	No
7	50	F	C	right	Teacher	50	3 mo.s	No	No

F = female; M = male; A = Asian; C = Caucasian; yr. = year; mo.s = months

## CONCLUSIONS

The purpose of this report is to draw attention to, characterize, and classify the broad spectrum of phenomenology associated with focal dystonia. We have selected seven patients with focal dystonia who manifest four patterns of abnormal movements: 1. *ipsilateral overflow* (N = 3), 2. *contralateral overflow* (N = 2), 3. *contralateral dystonia* (N = 6), and 4. *mirror movement* (N = 1). Jedynak and colleagues found that 29 of their 65 (44.6%) patients with WC had abnormal posture of fingers or hands induced by writing or drawing with the opposite hand. [Jedynak et al., 2001] Although they used the term "mirror dystonia" to describe this phenomenon, we believe that the term "contralateral overflow dystonia" is more appropriate as the contralateral movement previously described was not identical (not "mirror") to the movement or posture of the opposite limb. Singer and colleagues reported 6 patients who had "mirror dystonia", as described by Jedynak et al. [Singer et al., 2005] They found the presence of contralateral overflow dystonia helpful in differentiating between primary and compensatory movements and used it as a guide to select muscles to be targeted for injection with botulinum toxin. Although we have not reported the effects of botulinum toxin in our patients, as our primary aim of this paper is to focus on phenomenology, we have also found the abnormal pattern of contraction in the contralateral limb may be helpful in selection of muscles for botulinum toxin injections. We believe that our observations and proposed categorization of abnormal patterns provide a framework for future studies.

Table 2: Overflow - Mirror Movements in Focal Dystonia

Case	Dominant-writing	Non-Dominant writing	Examination	Diagnosis
1	Extension of right second finger, contraction of right biceps	Extension of right second, third and fourth fingers	Normal	WC Ipsilateral overflow contralateral dystonia
2	Extension of right second finger	Extension of right second finger	Normal	WC contralateral dystonia
3	Extension of right third finger	Extension of right third finger	Normal	WC contralateral dystonia
4	Extension of right wrist, contraction of right biceps, pectoralis major muscles	Extension and abduction of right wrist and jerking	Non-dominant hand: contralateral mirror movements	FC Ipsilateral overflow contralateral dystonia MM
5	Flexion of right fifth finger, lifting of right elbow and shoulder	Abduction of right thumb and flexion of right second finger	Non-dominant hand: Contralateral abduction and flexion of right fourth finger	FC contralateral and Ipsilateral overflow
6	Flexion of right wrist	Flexion of right wrist	Non-dominant hand: Contralateral abduction of right wrist	FC contralateral overflow and dystonia
7	Extension of right second finger	Extension of right second, third, fourth and fifth fingers flexion of right thumb	Non-dominant hand: Extension of third and fourth fingers	FC contralateral dystonia

WC = writer's cramp, FC = focal hand dystonia, MM = mirror movements

## VIDEO ILLUSTRATION

### Legends to the Videos

**Segment 1:** Case 1 - As soon as the patient starts writing the right second finger extends at the metacarpophalangeal joint and flexes at the proximal and distal interphalangeal joints. While writing with her left hand, the right second, third and fourth metacarpophalangeal joints extend.

**Segment 2:** Case 4 - When the patient's arms are outstretched in front of her body, there is abduction of the right wrist. When writing with her intact left hand there is an abduction and extension of the right wrist and extension of the 3rd finger of the metacarpophalangeal joint and flexion of the proximal and distal interphalangeal joints.

**Segment 3:** Case 5 - With repetitive movements of her left hand, there is extension and abduction of the right fifth finger. While writing with the right hand the right thumb abducts.

## REFERENCES

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