

## Articles

# The “Head Snap”: A Subtle Clinical Feature During the Finger–Nose–Finger Maneuver in Essential Tremor

Eliezer J. Sternberg<sup>1,2</sup>, Roy N. Alcalay<sup>3,4</sup>, Oren A. Levy<sup>3</sup> & Elan D. Louis<sup>1,3,4,5\*</sup>

<sup>1</sup>GH Sergievsky Center, College of Physicians and Surgeons, Columbia University, New York, New York, United States of America, <sup>2</sup>Tufts University School of Medicine, Boston, Massachusetts, United States of America, <sup>3</sup>Department of Neurology, College of Physicians and Surgeons, Columbia University, New York, New York, United States of America, <sup>4</sup>Taub Institute for Research on Alzheimer’s Disease and the Aging Brain, Columbia University, New York, New York, United States of America, <sup>5</sup>Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, New York, United States of America

## Abstract

**Background:** Essential tremor is characterized by several hyperkinetic movements, including arm and head tremors. We report another movement of the head in patients with essential tremor, which we term the “head snap.” This was observed as a jerking motion of the head in some patients while they performed the finger–nose–finger maneuver.

**Methods:** We compared the prevalence of the head snap in essential tremor patients vs. Parkinson’s disease patients. We also assessed the clinical correlates of the head snap.

**Results:** Ten (20%) of 50 essential tremor patients exhibited a head snap of any severity (rating  $\geq 0.5$ ) vs. 0 of 50 Parkinson’s disease patients ( $p=0.001$ ). Patients with head snap had more severe arm tremor on Archimedes spiral drawings ( $p=0.019$ ) and were more likely to have head tremor ( $p=0.03$ ) than those without it.

**Conclusions:** This sign could be a useful aid in the clinical diagnosis of tremor.

**Keywords:** Essential tremor, clinical, examination, diagnosis, Parkinson’s disease

**Citation:** Sternberg EJ, Alcalay RN, Levy OA, et al. The “head snap”: a subtle clinical feature during the finger–nose–finger maneuver in essential tremor. *Tremor Other Hyperkinet Mov* 2013; 3: <http://tremorjournal.org/article/view/159>

\*To whom correspondence should be addressed. E-mail: EDL2@columbia.edu

**Editor:** Julian Benito-Leon, Hospital “12 de Octubre”, Madrid, Spain

**Received:** February 13, 2013 **Accepted:** March 11, 2013 **Published:** April 18, 2013

**Copyright:** © 2013 Sternberg et al. This is an open-access article distributed under the terms of the Creative Commons Attribution–Noncommercial–No Derivatives License, which permits the user to copy, distribute, and transmit the work provided that the original author(s) and source are credited; that no commercial use is made of the work; and that the work is not altered or transformed.

**Funding:** This research was funded by R01 NS039422 from the National Institutes of Health (NIH).

**Financial disclosures:** None.

**Conflict of interest:** The authors report conflicts of interest.

## Introduction

On clinical examination, patients with essential tremor (ET) primarily exhibit kinetic tremor of the arms, although they may also demonstrate postural and rest tremors.<sup>1</sup> Approximately 40% of ET patients also display an intentional component to their arm tremor during goal-directed, fine motor tasks such as the finger–nose–finger maneuver. In ET, tremor may be found in other body regions, including the head, where the tremor is postural (i.e., present while upright rather than supine).<sup>2–4</sup> Furthermore, it has even been observed that 9% of ET patients exhibit intention tremor of the head during goal-directed movement of the hands (e.g., finger–nose–finger maneuver).<sup>5</sup>

Here, we report another subtle movement of the head that we have observed in patients with ET that, as far as we can tell, has not been

reported in the literature. The movement we have observed is a jerking motion of the head, noticeable in some ET patients, which occurs while the patients engage in the finger–nose–finger maneuver. The aim of this study is to provide videotape documentation of this phenomenon, to estimate its prevalence in a sample of ET patients vs. a sample of patients with another common movement disorder (Parkinson’s disease [PD]), and to assess its clinical correlates.

Given the high misdiagnosis rate of ET (approximately 30–50% of cases),<sup>6</sup> with the main source of misclassification being ET vs. PD, our hope is that attention to this physical sign would facilitate a more accurate diagnosis of tremor disorders.

## Methods

Beginning in March 2012 and ending in July 2012, ET and PD patients  $\geq 18$  years of age were enrolled prospectively and consecutively

**Table 1.** Demographic Characteristics and Clinical Examination Findings of Essential Tremor and Parkinson's Disease Patients

|  | ET Patients (N=50) | PD Patients (N=50) | Significance                   |
|--|--------------------|--------------------|--------------------------------|
| Age (years)  | 63.6 ± 15.3        | 68.0 ± 10.5        | t=1.67, p=0.10                 |
| Female gender  | 25 (50%)           | 20 (40%)           | χ <sup>2</sup> =1.01, p=0.32   |
| Education (years)  | 15.9 ± 3.7         | 15.9 ± 3.4         | t=0.09, p=0.93                 |
| Right handed   | 43 (86%)           | 45 (90%)           | χ <sup>2</sup> =0.71, p=0.87   |
| Duration of tremor symptoms (years)                                | 21.1 ± 15.0        | 9.0 ± 6.6          | t=5.21, p<0.001                |
| <b>Hoehn and Yahr Stage</b>  | Not applicable     |                    | Not applicable                 |
| I or II  |                    | 41 (82%)           |                                |
| III  |                    | 6 (12%)            |                                |
| IV or V  |                    | 3 (6%)             |                                |
| <b>ET or PD Medications</b>  |                    |                    |                                |
| Carbidopa/levodopa   | 0 (0%)             | 41 (82%)           | χ <sup>2</sup> =69.49, p<0.001 |
| Dopamine agonist   | 0 (0%)             | 12 (24%)           | χ <sup>2</sup> =13.64, p<0.001 |
| Anticholinergic agent  | 0 (0%)             | 0 (0%)             | χ <sup>2</sup> =0.00, p=1.00   |
| Amantidine   | 0 (0%)             | 7 (14%)            | χ <sup>2</sup> =7.53, p=0.01   |
| Propranolol  | 18 (36%)           | 1 (2%)             | χ <sup>2</sup> =18.78, p<0.001 |
| Other beta-blocker   | 1 (2%)             | 0 (0%)             | χ <sup>2</sup> =1.01, p=0.32   |
| Primidone  | 12 (24%)           | 0 (0%)             | χ <sup>2</sup> =13.64, p<0.001 |
| Other ET medication  | 6 (12%)            | 0 (0%)             | χ <sup>2</sup> =6.38, p=0.01   |
| Botulinum toxin injections   | 0 (0%)             | 2 (4%)             | χ <sup>2</sup> =2.04, p=0.15   |
| Deep brain stimulation surgery                                     | 0 (0%)             | 5 (10%)            | χ <sup>2</sup> =5.26, p=0.02   |
| <b>Postural Tremor Rating<sup>1,2</sup></b>                        |                    |                    |                                |
| Straight arm   | 1.08 ± 0.68        | 0.61 ± 0.57        | MW=3.59, p<0.001               |
| Winged arm   | 1.16 ± 0.64        | 0.55 ± 0.60        | MW=4.60, p<0.001               |
| Kinetic tremor rating (finger–nose–finger maneuver) <sup>1,2</sup> | 1.77 ± 0.35        | 1.17 ± 0.49        | MW=5.66, p<0.001               |
| Archimedes spiral rating <sup>1,2</sup>                            | 2.08 ± 0.69        | 0.98 ± 0.81        | MW=6.25, p<0.001               |
| Intention tremor rating <sup>3</sup>                               | 0.56 ± 0.33        | 0.16 ± 0.28        | MW=5.66, p<0.001               |
| <b>Rest Tremor Rating</b>  |                    |                    |                                |
| Arms <sup>1,4</sup>  | 0.06 ± 0.24        | 0.74 ± 1.01        | MW=4.18, p<0.001               |
| Legs <sup>1,4</sup>  | 0.00 ± 0.00        | 0.20 ± 0.61        | MW=2.51, p=0.01                |
| Face <sup>1</sup>  | 0.00 ± 0.00        | 0.16 ± 0.42        | MW=2.73, p=0.006               |
| Head tremor present  | 22 (44%)           | 6 (12%)            | χ <sup>2</sup> =12.70, p<0.001 |
| Head snap (severity ≥0.5)  | 10 (20%)           | 0 (0%)             | χ <sup>2</sup> =11.11, p=0.001 |
| Head snap (severity ≥1)  | 5 (10%)            | 0 (0%)             | χ <sup>2</sup> =5.26, p=0.022  |

Abbreviations:  $\chi^2$ , chi-square test; t, Student's t-test; ET, essential tremor; PD, Parkinson's disease; MW, Mann-Whitney test.

<sup>1</sup>Ratings are taken from the more severely affected limb.

<sup>2</sup>Range=0-3.

<sup>3</sup>Range=0-1.

<sup>4</sup>Range=0-4.

from the clinical practices of three movement disorder neurologists (R.N.A., O.A.L., E.D.L.) at the time of regularly scheduled outpatient visits. The initial diagnosis of ET was based on the presence of moderate or greater amplitude action tremor in the arms or head in the absence of another known cause (e.g., medications, PD, dystonia); this diagnosis was reconfirmed in each case using published diagnostic criteria.<sup>7</sup> The PD diagnosis was based on the presence of two or more cardinal features of parkinsonism in the absence of other possible causes (e.g., medication, atypical parkinsonian syndromes). There were five refusals. Each enrollee signed a Columbia University Medical Center Institutional Review Board consent form.

Patients from both groups filled out the same semi-structured demographic and clinical questionnaires designed for this study. The patients then underwent a videotaped neurological examination that included assessments of postural tremor (straight arm and winged) and the finger-nose-finger maneuver (patient touches his or her nose followed by the examiner's finger in an alternating fashion to test for kinetic and intention tremor, 10 repetitions per arm). The camera was positioned so the patients' upper limbs and head were visible at all times. Each patient was also asked to draw an Archimedes spiral with each hand. Other maneuvers tested included finger taps and repeated opening and closing of the fist to assess limb bradykinesia. A Hoehn and Yahr score was assigned to each PD patient.<sup>8</sup>

The videotaped examinations were reviewed by a senior neurologist specializing in movement disorders (E.D.L.), who rated the severity of postural and kinetic arm tremors using the Washington Heights-Inwood Genetic Study of Essential Tremor rating scale (0-3),<sup>9</sup> presence vs. absence of head tremor, and severity of rest tremor in different body regions using the Unified Parkinson's Disease Rating Scale (0-4).<sup>10</sup> Intention tremor was rated as 0 (absent), 0.5 (probable), or 1 (definite), as described.<sup>7</sup> The head snap, if present, was observed as a jerking motion of the head, occurring while the patients performed the finger-nose-finger maneuver, as their finger reached their nose (videotape). It was distinguished from head tremor because it was a single unidirectional jerking motion and it did not have an oscillatory quality. In addition, it was not directly preceded by oscillatory head movements. The head snap was rated as absent (0), probable (0.5), or definite (1).

Our pre-study goal was to enroll 50 ET and 50 PD cases; this number was based on initial sample size calculations, which determined that this number of patients would provide 81.5% power to detect a situation in which 15% of the ET patients and <1% of the controls had a head snap (assuming  $\alpha=0.05$  and two-tailed testing).

Statistical analyses were performed in SPSS (version 19; Chicago, Illinois). We used  $\chi^2$  to assess categorical data and Student's t tests to

assess continuous data; in some cases, non-parametric testing (Mann-Whitney tests) was used to analyze ordinal data.

## Results

The ET and PD patients were similar in age, gender, education, and clinical variables (Table 1). As expected, a larger proportion of PD patients had deep brain stimulation surgery, and ET patients had longer disease duration than PD patients (Table 1).

On examination, ET patients had more severe kinetic and postural tremors than PD cases, whereas PD cases had more severe rest tremor (Table 1). Our ET patients had a range of tremor severities, including those with mild tremor (e.g., 16 out of 50 [32%] had an Archimedes spiral tremor rating in their more severely affected limb that was <2).

Ten (20%) ET patients exhibited a head snap of any severity (rating  $\geq 0.5$ ) vs. no (0%) PD patients ( $p=0.001$ ); five (10%) ET patients exhibited a head snap rating=1 vs. no PD patients ( $p=0.028$ ) (Table 1 and videotape).

ET patients with head snap did not differ from those without head snap in terms of their age ( $t=0.63$ ,  $p=0.53$ ) or gender ( $\chi^2=0.00$ ,  $p=1.00$ ), but there was a trend for their tremor duration to be longer ( $28.5 \pm 12.5$  vs.  $19.2 \pm 15.1$ ,  $p=0.08$ ). Patients with head snap had Archimedes spiral drawings of greater severity than those without it ( $2.2 \pm 0.6$  vs.  $2.0 \pm 0.7$ ,  $p=0.019$ ). Eight (80%) of the 10 ET patients with the head snap also had head tremor, while 14 (35%) of the 40 ET patients without head snap exhibited head tremor ( $\chi^2=4.88$ ,  $p=0.03$ ). Head snap occurred in two out of 28 (7.1%) ET patients without head tremor.

## Discussion

Our results indicate that one in five ET cases exhibited a head snap during the finger-nose-finger maneuver. By comparison, none of the PD patients exhibited a head snap. In ET, head snap seemed to be associated with several indicators of more advanced disease (greater severity of tremor on Archimedes spiral, longer duration of tremor, presence of head tremor).

Examiners should perform several repetitions of the finger-nose-finger maneuver before concluding that head snap is present or not, as in some trials of this maneuver, it may occur, but not in others (Video 1).

What is the head snap? There are several possibilities. First, given its jerky quality, the head snap could be a very mild form of stimulus-induced myoclonus. Severe forms of stimulus-induced myoclonus have been reported in the context of hypoxic encephalopathy and can occur as singular or multiple jerks that, though usually limited to the moving extremity, can occur in other bodily regions including the head. This form of myoclonus is associated with intention tremor as well as other



Patient 1



Patient 2



Patient 3

**Video 1. Three Essential Tremor (ET) Patients Performing the Finger–Nose–Finger Maneuver.** The head snap was observed as a jerking motion of the head, occurring while the patients performed the finger–nose–finger maneuver, as their finger reached their nose. It was distinguished from head tremor because it was a single unidirectional jerking motion without an oscillatory quality. These ET patients were also enrolled in a home-based epidemiological study, and optimal footage of the head snap was derived from those videotaped examinations.

cerebellar findings.<sup>11</sup> Second, the head snap could represent a manifestation of cerebellar ataxia, which can be associated with jerking movements of the body.<sup>12</sup> It is possible that, as the finger approaches the nose, the subject attempts to adjust his or her head position. Owing to a defect in the force and/or timing of the movement,<sup>13</sup> this translates into the head snap. Interestingly, a similar jerking motion of the head has been reported in patients suffering from spastic ataxia, a hereditary disorder of variable presentation in which pyramidal tract features overlap with cerebellar findings. In addition, observations of familial, non-epileptic jerking motions of the head have also been reported in patients with ataxia.<sup>14</sup>

The strengths of this study include the comparison of ET with PD patients, the use of video recordings so that segments could be replayed if necessary, and the detailed analysis of all footage by a senior neurologist specializing in movement disorders.

In summary, we report an interesting movement of the head in patients with ET. To our knowledge, this movement, which we term the “head snap,” has not been reported previously. The head snap was observed as a jerking motion of the head, noticeable in some ET patients, that occurred while they performed the finger–nose–finger maneuver. Given the high misdiagnosis rate of ET (approximately 30–50% of cases),<sup>6</sup> with the main source of misclassification being ET vs. PD, our hope is that attention to this physical sign would facilitate the more accurate diagnosis of tremor disorders in clinical settings. The extent to which this sign is present more widely in disorders of the cerebellar system also deserves additional study, as does an examination of its electrophysiological features.

### Acknowledgment

The authors would like to acknowledge Dr Paul Greene, Columbia University Medical Center, for referring patients to this study.

### References

1. Brennan KC, Jurewicz E, Ford B, et al. Is essential tremor predominantly a kinetic or a postural tremor? A clinical and electrophysiological study. *Mov Disord* 2002;17:313–316, doi: <http://dx.doi.org/10.1002/mds.10003>.
2. Hubble J P, Busenbark KL, Pahwa R, et al. Clinical expression of essential tremor: effects of gender and age. *Mov Disord* 1997;12:969–972, doi: <http://dx.doi.org/10.1002/mds.870120620>.
3. Louis ED, Ford B, Frucht S. Factors associated with increased risk of head tremor in essential tremor: a community-based study in northern Manhattan. *Mov Disord* 2003;18:432–436, doi: <http://dx.doi.org/10.1002/mds.10395>.

4. Agnew A, Frucht SJ, Louis ED. Supine head tremor: a clinical comparison of essential tremor and spasmodic torticollis patients. *J Neurol Neurosurg Psychiatry* 2012;83:179–181, doi: <http://dx.doi.org/10.1136/jnnp-2011-300823>.
5. Leegwater-Kim J, Louis ED, Pullman SL, et al. Intention tremor of the head in patients with essential tremor. *Mov Disord* 2006;21:2001–2005, doi: <http://dx.doi.org/10.1002/mds.21079>.
6. Jain S, Lo SE, Louis ED. Common misdiagnosis of a common neurological disorder: how are we misdiagnosing essential tremor? *Arch Neurol* 2006;63:1100–1104, doi: <http://dx.doi.org/10.1001/archneur.63.8.1100>.
7. Louis ED, Frucht SJ, Rios E. Intention tremor in essential tremor: prevalence and association with disease duration. *Mov Disord* 2009;24:626–637, doi: <http://dx.doi.org/10.1002/mds.22370>.
8. Goetz CG, Poewe W, Rascol O, et al. Movement Disorder Society Task Force report on the Hoehn and Yahr staging scale: status and recommendations the Movement Disorder Society Task Force on rating scales for Parkinson's disease. *Mov Disord* 2004;19:1020–1028, doi: <http://dx.doi.org/10.1002/mds.20213>.
9. Louis ED, Ottman R, Ford B, et al. The Washington Heights-Inwood Genetic Study of Essential Tremor: methodologic issues in essential-tremor research. *Neuroepidemiology* 1997;16:124–133, doi: <http://dx.doi.org/10.1159/000109681>.
10. Fahn S, Elton RL, UPDRS program members. Unified Parkinson's Disease rating scale. In: Fahn S, Marsden CD, Goldstein M, Calne DB, editors. *Recent developments in Parkinson's Disease*. Florham Park, NJ: Macmillan Healthcare Information; 1987. p 153–163. (vol. 2).
11. Lance JW, Adams RD. The syndrome of intention or action myoclonus as a sequel to hypoxic encephalopathy. *Brain* 1963; 90: 111–136, doi: <http://dx.doi.org/10.1093/brain/86.1.111>.
12. Goldvasser D, McGibbon CA, Krebs DE. High curvature and jerk analyses of arm ataxia. *Biol Cybern* 2001;84:85–90, doi: <http://dx.doi.org/10.1007/s004220000201>.
13. Ivry RB, Spencer RM, Zelaznik HN, et al. The cerebellum and event timing. *Ann N Y Acad Sci* 2002;978:302–317, doi: <http://dx.doi.org/10.1111/j.1749-6632.2002.tb07576.x>.
14. Grewal KK, Stefanelli MG, Meijer IA, et al. A founder effect in three large Newfoundland families with a novel clinically variable spastic ataxia and supranuclear gaze palsy. *Am J Med Genet A* 2004;31:249–254, doi: <http://dx.doi.org/10.1002/ajmg.a.30397>.