

## Clinical and Electrophysiologic Analysis of Essential tremor

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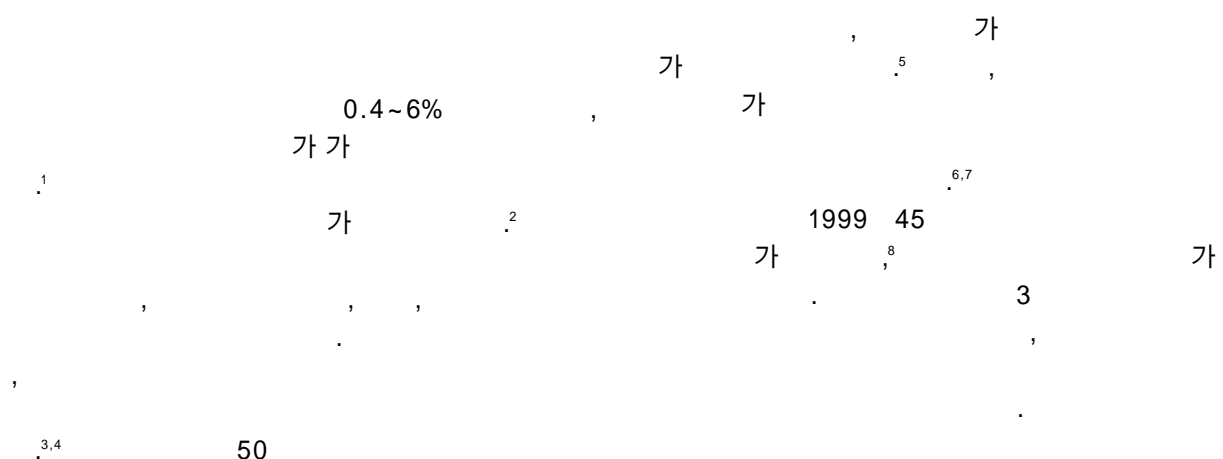
**Background:** Essential tremor (ET) is a common movement disorder that often causes functional disability. There have been very few investigations about the clinical characteristics of ET in Korea. Therefore, we performed a study showing the clinical features and electrophysiological findings of ET.

**Methods:** We analyzed medical records and accelerometry data of 152 patients (male vs female; 79 vs 73) with ET, who visited the Neurology Clinic of Hospital from 2000 to 2003. Clinical characteristics of ET were summarized including the age of onset, family history, tremor type, body part involved, and associated symptoms. The frequency of tremor was recorded and the spectral analysis of tremor was performed.

**Results:** The age of tremor onset showed bimodal distribution with peaks in the 2nd and 5th decades. Family history was found in 46 patients (30.3%). The patients with the family history presented earlier onset of tremor than patients without the history (mean age of onset, y: 35.2 vs. 49.9,  $P < 0.001$ ). Tremor appeared most frequently in hands (94%), and followed by head (25%). In head tremor, "no-no" pattern was mainly observed and the head tremor was more frequently observed in female. The frequency of tremor was negatively correlated with age ( $r = -0.49$ ,  $P < 0.001$ ).

**Conclusions:** The present study indicated some important findings about ET: (1) bimodal distribution for an age of onset, (2) younger age of onset in patients with a family history, (3) decreasing frequency of the tremor according to age, and (4) higher prevalence of head tremor in female patients.

**Key Words:** Essential tremor, Frequency, Age factor, Electrophysiology



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1.

2000 3 1 2003 10 1

fast Fournier transforms

6  
가  
가  
가  
79 (52%), 73 (48%)  
152

(degrees/second)  
3.  
SPSS for windows  
(version 11.5)  
Student t-test  
Chi-square  
Pearson  
P 0.05

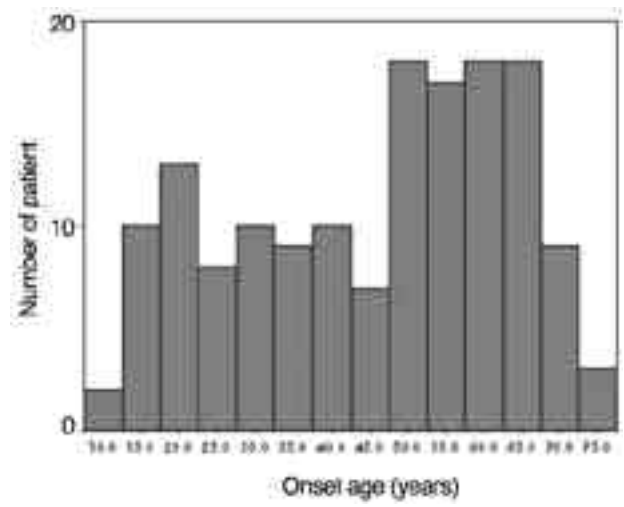
1)  
가  
(postural) (kinetic)  
"no - no" "yes - yes"  
dystonia,  
cervical dystonia, parkinsonism, writer's cramp,  
blepharospasm, myoclonus

10 16 20 25  
30 19 40 20 50 60  
36 30 20 50 (bimodal  
peak)  
45.5±17.7 (11~76 )  
9.6±9.3 (3~69 )  
55.1±17.1 (15 ~89 ) 가  
( = -0.49, P< 0.001, Fig. 2),  
( = 0.21, P< 0.05).

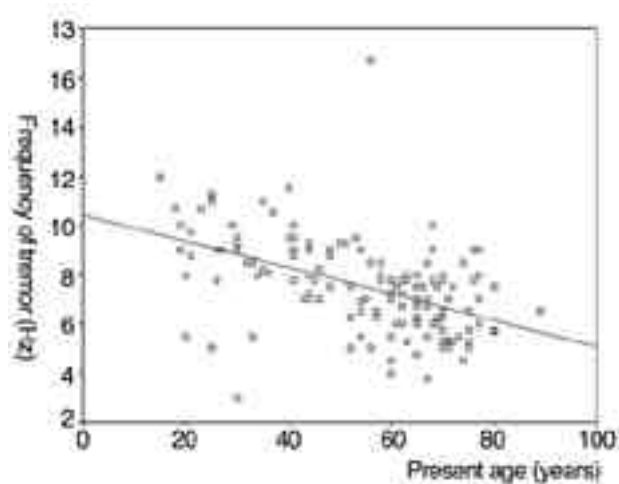
2)  
(gyro-  
scope) Motus I (Motus Bioengineering Inc.,  
Benicia, CA, U.S.A.) angular rate  
sensor (Solid state gyroscope; 1.49", 60g,  
1250 deg/sec range)

가  
(Table 1). 39.1±18.0  
52.3±14.6  
(P<0.001).

(metacarpophalangeal joint) 1 cm  
가 (pronation)  
가  
2 cm band



**Figure 1.** Distribution of age of tremor onset. Note the bimodal distribution with one peak at the 2nd decade and another at the 5th decade.



**Figure 2.** The scatter plots of age and frequency of tremor in patients with essential tremor. (Correlation coefficient = -0.49,  $P < 0.001$ ). Note that the frequency of tremor is negatively associated with age. Straight line corresponds fit.

38 (11.4%), 29 (39.7%), 9  
 (P<0.001), 가  
 152 46 (30.3%), 가  
 35.2±17.3 가  
 49.9±16.0  
 (P<0.001). 가 ( )  
 Table 2  
 7.5±1.9 Hz, 5~10 Hz  
 117  
 (77.0%), 26 (17.1%),  
 9 (5.9%)  
 7.7±1.9  
 Hz, 6.7±1.8 Hz 가  
 (P=0.026),  
 (P=0.021).  
 44.7±17.7, 45.0±19.4  
 61.7±9.8, 52.9±  
 18.6  
 (P<0.001),  
 52.7±12.4  
 18.6 (P<0.001). 가  
 38  
 (25%), 8 (5.3%), 5 (3.3%), 가  
 2 (1.3%) 1 (0.7%)

**Table 1.** Characteristics of patients by sex and family history

	Sex		Family history of tremor
	Men (n=79)	Women (n=73)	
Age, years	49.6±18.9	61.2±12.5*	Negative (n=106) 59.2±14.9*
Age of onset, years	39.1±18.0	52.3±14.6*	Positive (n=46) 45.8±18.3 49.9±16.0*
Symptom duration, years	10.5±10.6	8.6±7.7	10.6±8.9 9.1±9.5
Characteristics of tremor			
Frequency, Hz	7.8±1.8	7.2±1.9	7.6±1.9 7.5±1.9
Amplitude, deg/sec	8.2±17.9	9.4±19.1	11.0±22.8 7.7±16.0
Cases of head involvement, %	11.4	39.7*	13.0 30.2†

Values are represented as mean ± S.D., \*  $P < 0.001$ , †  $P < 0.05$  by Student t-test or chi-square test as appropriate.

**Table 2.** Comparison of characteristics by the presence of head tremor and the type of dominant hand tremor

	Head tremor		Type of dominant hand tremor	
	Positive (n=38)	Negative (n=114)	Postural (n=26)	Kinetic (n=117)
Age, years	61.7±9.8	52.9±18.5*	53.9±16.9	57.5±19.5
Age of onset, years	52.7±12.4	43.0±18.6*	44.7±17.7	45.0±19.4
Symptom duration, years	8.8±6.9	9.8±9.9	9.1±8.3	12.5±13.5
Characteristics of hand tremor				
Frequency, Hz	7.3±2.3	7.5±1.8	7.7±1.9	6.7±1.8†
Amplitude, deg/sec	11.3±22.9	8.1±17.1	6.7±10.9	17.9±22.1†

Values are represented as mean ± S.D., \* P < 0.001, † P < 0.05 by Student t-test or chi-square test as appropriate.

가 42, 13, 2, 10, 5.3±1.2 Hz (3.8~10.0 Hz), “no-no” 가 32 (84.2%), “yes-yes” 가 6 (15.8%), cervical dystonia가 4, parkinsonism 3, writer’s cramp 2, dystonia 2, blepharospasm myoclonus가 1.

152, 40, 60, 60, 20, 20, 50, 가 17~70%, 5,6,13,14, 2p22-p25 3q13, 13, 가, 40%, 가, 가, 8, Koller, 가, 30%, 가, 35, 가, 50, 가, 14, 가, 30.3%, 17,18, Elble

가 ,

Koller 가 , 8 , 14

Bain

가 , 19 Lou 가 13

가 4 , Louis , Lou

5 Louis Lou

35% 6,20

3

3,20 “no - no”

“yes - yes”

Critchley “yes - yes”

21 Bain “no - no” 가

19 “no - no”

75% 가 84%

dystonia , Koller parkinsonism

가

가 , 14 Jankovic

22-24 350

6 cervical dystonia, Parkinsonism, writer’s cramp, dystonia, blepharospasm, myoclonus

가 가

가

## REFERENCES

1. Louis ED, Marder K, Cote L, Pullman S, Ford B, Wilder D, et al. Differences in the prevalence of essential tremor among elderly African Americans, whites, and Hispanics in northern Manhattan, NY. *Arch Neurol* 1995;52:1201-1205.
2. Rajput A, Robinson CA, Rajput AH. Essential tremor course and disability: A clinicopathologic study of 20 cases. *Neurology* 2004;62:932-936.
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.
4. Valls-Sole J, Tolosa ES, Nobbe F, Dieguez E, Munoz E, Sanz P, et al. Neurophysiological investigations in patients with head tremor. *Mov Disord* 1997;12:576-584.
5. Hubble JP, Busenbark KL, Koller WC. Essential tremor. *Clin Neuropharmacol* 1989;12:453-482.
6. Lou JS, Jankovic J. Essential tremor: clinical correlates in 350 patients. *Neurology* 1991;41:234-238.
7. Jankovic J. Essential tremor: a heterogenous disorder. *Mov Disord* 2002;17:638-644.
8. Kim SS, Kim DH, Kim JW. Clinical features of essential tremor. *J Korean Neurol Assoc* 1999;17:528-533.
9. Elble RJ. Diagnostic criteria for essential tremor and differential diagnosis. *Neurology* 2000;54:S2-6.
10. Jankovic J. Essential tremor: clinical characteristics. *Neurology* 2000;54:S21-25.
11. Bain PG, Findley LJ, Atchison P, Behari M, Vidailhet M, Gresty M, et al. Assessing tremor severity. *J Neurol Neurosurg Psychiatry* 1993;56:868-873.
12. Burkhard PR, Shale H, Langston JW, Tetrad JW.

dystonia (47.1%), cervical dystonia (26.8%), Parkinsonism (20.2%), writer’s cramp (13.7%), blepharospasm (7.4%), myoclonus (2.2%)

- Quantification of dyskinesia in Parkinson 's disease: validation of a novel instrumental method. *Mov Disord* 1999;14:754-763.
13. Larsson T, Sjogren T. Essential tremor: a clinical and genetic population study. *Acta Psychiatr Scand* 1960;36 (Suppl 144):1-176.
  14. Koller WC, Busenbark K, Miner K. The relationship of essential tremor to other movement disorders: report on 678 patients. Essential Tremor Study Group. *Ann Neurol* 1994;35:717-723.
  15. Gulcher JR, Jonsson P, Kong A, Kristjansson K, Frigge ML, Karason A, et al. Mapping of a familial essential tremor gene, FET1, to chromosome 3q13. *Nat Genet* 1997;17:84-87.
  16. Higgins JJ, Pho LT, Nee LE. A gene (ETM) for essential tremor maps to chromosome 2p22-p25. *Mov Disord* 1997;12:859-864.
  17. Elble RJ, Higgins C, Leffler K, Hughes L. Factors influencing the amplitude and frequency of essential tremor. *Mov Disord* 1994;9:589-596.
  18. Elble RJ. Essential tremor frequency decreases with time. *Neurology* 2000;55:1547-1551.
  19. Bain PG, Findley LJ, Thompson PD, Gresty MA, Rothwell JC, Harding AE, et al. A study of hereditary essential tremor. *Brain* 1994;117 ( Pt 4):805-824.
  20. Hubble JP, Busenbark KL, Pahwa R, Lyons K, Koller WC. Clinical expression of essential tremor: effects of gender and age. *Mov Disord* 1997;12:969-972.
  21. Critchley E. Clinical manifestations of essential tremor. *J Neurol Neurosurg Psychiatry* 1972;35:365-372.
  22. Jankovic J, Beach J, Schwartz K, Contant C. Tremor and longevity in relatives of patients with Parkinson 's disease, essential tremor, and control subjects. *Neurology* 1995; 45:645-648.
  23. Jankovic J, Beach J, Pandolfo M, Patel PI. Familial essential tremor in 4 kindreds. Prospects for genetic mapping. *Arch Neurol* 1997;54:289-294.
  24. Jankovic J, Leder S, Warner D, Schwartz K. Cervical dystonia: clinical findings and associated movement disorders. *Neurology* 1991;41:1088-1091.