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Research Article

Clinical and Electrooculographical Finding in Patient with Essential Tremor

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Abstract

Background: Essential Tremor (ET) is the most common movement disorder, yet the location of the primary disease substrate continues to be a matter of debate. In this study, we aimed to evaluate ocular movement abnormalities with Electrooculography (EOG) in patients with ET to find a possible location of disease pathology.

Methods: Electrooculographic evaluation including saccade, tracking, optokinetic, gaze and positional tests were performed to 36 ET patients and 36 healthy subjects. Patient age on the onset of the tremor, duration of the disease, characteristics and the location of the tremor were also investigated. Fahn-Tolosa-Marin tremor rating scale was used to determine the tremor severity. Differences of abnormal test results between patient and control groups were analysed with Pearson's and Fisher's Exact and correlation analyses of EOG tests and clinical data were performed with Spearman's and Pearson's correlation tests.

Results: There was not any significant difference in EOG tests between the ET patients and controls. Significant correlation was only found between EOG abnormality and patient age in correlation analyses.

Conclusions: Our results showed that ET patients may not have specific EOG test abnormalities. These tests would be used especially in the different diagnosis of other movement disorders.

Keywords: Essential tremor; Electrooculography; Eye movements; Movement disorders

Introduction

Essential Tremor (ET) is the most common movement disorder. It is characterized by gradually increasing postural and kinetic tremor without endogenous and exogenous triggers and other neurological symptoms [1]. The pathophysiology of ET is not completely known [2]. In many studies, supporting data have been obtained that essential tremor is caused by abnormalities in the Guillain-Mollaret triangle (rubral nucleus, olivary nucleus and cerebellum). It has been suggested that tremor is caused by intrinsic oscillations that originate from the inferior olivea, spreading with the olivocerebellar network [3]. Various data obtained from clinical, neuroimaging and animal studies show that the cerebellum is involved in the formation and spread of ET [4].

Electrooculography (EOG) is the most technically practical method for recording eye movements [5]. Cornearetinal potentials occur when the cornea carries a positive (+) charge, and the retina carries a negative (-) electrical charge during eye movements [6]. In EOG, it is possible to determine the affected area in the central nervous system after examining the gaze test, saccade test, trekking test, optokinetic test and positional test and collectively examining these all tests [7].

In this study, it was aimed to investigate if there are eye movement abnormalities in patients with ET by using EOG, which is used routinely, and it was aimed to examine possible EOG pathologies that may reveal dysfunction in the cerebellum, brainstem, thalamus, and pathways.

Methods

Subjects

Patients who met the definitive diagnosis of ET according to the Consensus statement of Movement Disorder Society on tremor were included to the study. Detailed disease history such as the age of onset of tremor, its duration, type, and the place of it were questioned. Patients who have abnormal values in their hemograms, biochemistry values, and thyroid function tests were excluded from the study. Fahn Tolosa, Marin clinical tremor rating scale was applied to all patients with ET and values were recorded. The findings were recorded by performing a neurological examination in all patients. As a result, 36 patients with ET who did not have cerebellar pathology examination findings such as vestibular complaint, ataxia, dysmetria and intentional tremor and who did not use any medication that could affect EOG tests and 36 patients with ET who did not use any medication that might affect the EOG tests and 36 healthy control group individuals similar in terms of age and gender were included in the study.

EOG Procedure

After the test records were passed through the 30 Hz Low Pass Filter, they were stored in the computer connected to the system

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(Chartr ENG, ICS medical, USA) and evaluated in terms of normal distribution and the angular velocity of the slow phase Slow-Phase Velocity (SPV). The wave recorded in the saccadic test was evaluated in terms of validity, latency, and amplitude as well as its morphology. Wave morphology and gain in the trekking test were examined. The numerical values in the saccadic and trekking tests were determined according to the normal group values registered in the computer program.

In the optokinetic test, 40 degrees/second stimulation was used, and it was investigated if there was any asymmetry. If the Slow Phase Velocity (SPV) difference between the two sides is more than 30 degrees/second or the difference is more than 50% of the greater value, it is considered asymmetrical.

Statistics

After all these procedures, the data obtained from EOG and the clinical information obtained from the patients were uploaded to the Statistical Package for Social Sciences 16 (SPSS 16.0) program for statistical analysis. The Pearson correlation test and Fisher's Exact Test were used to determine whether there was a difference in the number of patients with disorders in EOG tests and in the saccadic test, trekking test, optokinetic test, positional test and gaze test among the patient and control groups. Spearman Correlation test and Pearson Correlation test were used to investigate whether there was a relationship between EOG tests and the patient's age, disease duration, and the total value obtained on the Fahn Tolosa, Marin clinical tremor rating scale.

Results

A total of 72 participants, 36 patients with a diagnosis of ET and 36 healthy people, were included in this study. There was no statistically significant difference between the mean age of the patient group 441 ± 19.2 (min=18, max=78) and the mean age of the control group 45.3 ± 18.9 (min=19, max=79) (t=-0.272, p=0.786, Student's t test). Of the patient group, 24 (66.7%) were male and 12 (33.3%) were female. Of the control group, 22 (61.1%) were male and 14 (38.9%) were female, and there was no significant difference between the two groups (p=0.806).

In patients, the mean age of onset of tremor was 31.6 ± 16.6 (min=13, max=72) years, and the mean duration of the disease was 12.1 ± 7.8 (min=5, max=40) years. When the form of tremor was examined, it was found that only postural tremor in 2 cases (5.6%), postural and kinetic tremor in 27 cases (75%), postural and kinetic tremor in 7 cases (19.4%) were found to be accompanied by resting tremor. It was found that 29 cases (80.6%) had a symmetrical tremor, and 7 cases (19.4%) had a slightly asymmetrical tremor. When the tremor region was examined, only upper extremity tremor in 27 cases (75%), upper and lower extremity tremor in 4 cases (11.1%), upper extremity and head tremor in 2 cases (5.6%), 2 cases (5.6%) upper extremity and voice tremor, 1 case (2.8%) had upper extremity, head and voice tremor were determined. The age of onset of tremor and the duration of the disease are shown in Table 1. The saccadic test was found to be pathological in 8 patients (22.2%) with ET, and an abnormality was found in the validity of the saccadic test in 2 cases (5.6%) and since these cases did not have wave morphology, saccade velocity and latency values, they were excluded from statistical studies and these tests were examined on 34 patients with ET. Disorder was found in 5 control group cases (13.9%), and an abnormality was found in the validity of the saccadic test in 1 case (2.8%) and these cases were excluded from statistical studies because they did not have wave morphology, saccad velocity and latency values, and these tests were examined on 35 participants.

Trekking test of 10 cases (27.8%) with ET is abnormal. Trekking test of 6 control group cases (16.7%) was abnormal. Optokinetic test was found abnormal in 5 cases (13.9%) with ET. Since 1 case from the control group participants could not comply with the optokinetic test, the evaluation was made on 35 participants, abnormalities were

Table 1: Age of onset of tremor and duration of illness in patients.

	Average	Standard Deviation	Median	Minimum Values	Maximum Values
Age of onset of tremor (year)	31	16,6	26,5	13	72
Disease duration (year)	12	7,8	10	5	40

Table 2: EOG test findings of the patient and control group.

	Patients with ET			Control Group		
	Normal n (%)	Disordered n (%)	Total n (%)	Normal (n%)	Disordered (n%)	Total (n%)
Saccade test	28 (77,8)	8 (22,2)	36 (100)	31 (86,1)	5 (13,9)	36 (100)
Saccade test-validity	34 (94,4)	2 (5,6)	36 (100)	35 (97,2)	1 (2,8)	36 (100)
Saccade test-wave morphology	34 (100)	0 (0)	34 (100)	35 (100)	0 (0)	35 (100)
Saccade test-peak saccad velocity	30 (88,2)	4 (11,8)	34 (100)	34 (97,1)	1 (2,9)	35 (100)
Saccade test-latencies	31 (91,2)	3 (8,8)	34 (100)	32 (91,4)	3 (8,6)	35 (100)
Trekking test	26 (72,2)	10 (27,8)	36 (100)	30 (83,3)	6 (16,7)	36 (100)
Trekking test-gain of velocity	29 (80,6)	7 (19,4)	36 (100)	31 (86,1)	5 (13,9)	36 (100)
Trekking test-wave morphology	31 (86,1)	5 (13,9)	36 (100)	33 (91,7)	3 (8,3)	36 (100)
Optokinetic test	31 (86,1)	5 (13,9)	36 (100)	33 (94,3)	2 (5,7)	35 (100)
Gaze test	35 (97,2)	1 (2,8)	36 (100)	36 (100)	0 (0)	36 (100)
Positional test	33 (91,7)	3 (8,3)	36 (100)	36 (100)	0 (0)	36 (100)

Table 3: The number of pathological tests and statistical significance levels found in the EOG tests of the patient and control groups.

	Patient	Control	p
Saccadic test	8	5	0,541
Saccade test-validity	2	1	1,000
Saccade test-wave morphology	0	0	-
Saccade test-peak saccad velocity	4	1	0,198
Saccade test-latencies	3	3	1,000
Trekking test	10	6	0,396
Trekking test-gain of velocity	7	5	0,753
Trekking test-wave morphology	5	3	0,710
Optokinetic test	5	2	0,429
Gaze test	1	0	1,000
Positional test	3	0	0,239

found in 2 cases (5.7%). The test was found to be normal in all control group participants while in the gaze test, disorder was detected in 1 case (2.8%) in cases with ET. While the disorder in the positional test was detected in 3 cases (8.3%) with ET, the test was found to be normal in all of the control group participants. Detailed EOG test results of the patient and control groups are shown in Table 2.

In EOG tests, no significant difference was found between the patients with ET and the control group (Fisher's Exact test). The number of pathological tests and statistical significance levels found in the EOG tests of the patient and control groups are shown in Table 3.

It was investigated whether there was a relationship between the presence of any test disorder in EOG and age, disease duration, Fahn Tolosa, including the total value of the Marin clinical tremor rating scale and while it was founded that there was a significant positive correlation between the presence of EOG and the age of the patient (r=0.522, p=0.001, Spearman Correlation test), disease duration (r=0.227, p=0.182, Spearman Correlation test) and Fahn; There was no significant correlation between the total value of Tolosa and Marin clinical tremor rating scale (r=-0.088, p=0.608, Spearman Correlation test).

Discussion

Structures that are effective in the pathophysiology of neurological diseases associated with movement disorders also play a role in the control of eye movements [2]. The number of studies examining eye movements in patients with ET is quite limited in the literature. The pathophysiology of ET is not fully known today [1-2]. Although cerebellar degeneration and Lewy bodies were found in a few brain autopsies, no significant pathological structural changes were found in postmortem brain or nerve tissue [1-8]. Functional neuroimaging studies support the presence of bilateral increased cerebellar activity [1-9]. In our study, it was aimed to make an indirect localization by examining the ocular abnormalities in patients with ET, but no significant result was found. This result may be since a pathology affecting the cerebellum, brainstem, thalamus, and pathways in patients with ET is not reflected in EOG tests.

Clinical detection of abnormal eye movements may not always be possible with repeated neurological examinations, and additional electrophysiological examinations may be required for the anatomical location of the lesion in these cases. There are many studies in which EOG is used to investigate vestibular system and eye movement pathologies in many neurological diseases like Parkinson's Disease, progressive supranuclear palsy, corticobasal degeneration, multisystem atrophy, Huntington's Disease, spinocerebellar ataxias, amyotrophic lateral sclerosis, benign essential blepharospasm, hemifacial spasm, Tourette's syndrome and spinocerebellar ataxias [10-11]. In the study of Helmchen et al., Eye movement abnormalities were examined by dividing the patient group into two groups as ET patients with significant intensive tremor (ETitis) and those with ET with prominent postural tremor (ETpt). In the studies of Helmchen et al., pathologies were found in patients with essential tremor, initial pursit eye movements, which can also be seen in cerebellar dysfunction, and in vestibulocular reflex suppression [12]. In this study, it was stated that there was no significant difference between the ET group and the healthy group in terms of saccadic eye movement speed [12]. In our study, no significant difference was found in saccade test results, so it can be said that there is no pathology that can be detected by electrophysiological testing in the saccade test in patients with ET, similar to the study of Helmchen et al.

Saccade latency disorder may occur in Parkinson's Disease, Alzheimer's Disease, or focal hemispheric lesions [13,14]. In a study by Baziyan et al., Prolongation of latency in saccades was shown in Parkinson's patients [13]. In general, no difference was found in eye movements between patients with ET and the control group in our study. In this case, it has been concluded that EOG can be used as a guiding test in differential diagnosis rather than its contribution to diagnosis in routine use.

In our study, correlation of disease duration and Fahn Tolosa, Marin clinical tremor rating scale with saccade test validity, saccade test velocity gain, saccade test latency, trekking test, trekking test velocity gain, trekking test wave morphology, optokinetic test and gaze test were examined and was no significant relationship. This showed that the duration and severity of the disease had no effect on the EOG tests. Our study showed that while saccadic test pathology, trekking test pathology, and the pathology in trekking speed gain tests showed a significant positive correlation with age in patients with ET, the control group's not showing this significant correlation led to the thought that the effects of the central nervous system areas that regulate these eye movements tend to occur more prominently with age in patients with ET.

With the EOG we routinely use in our study, no difference was found in eye movements between patients with ET and the control group. In our study, no results were obtained showing the ocular findings supporting the dysfunction of the brainstem, thalamus and the pathways of these regions, especially cerebellar dysfunction, which has been emphasized recently in ET pathophysiology. With this result, it can be said that we cannot obtain data that supports the cerebellar hypothesis, but this does not reject the hypothesis. There may be a pathology at a level that does not produce ocular findings.

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