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SHORT REPORT

Quantitative study of spontaneous eye blinks and eye tics in Gilles de la Tourette's syndrome

J H M Tulen, M Azzolini, J A de Vries, W H Groeneveld, J Passchier, B J M van de Wetering

Abstract

Spontaneous eye blink rate and frequency of eye tics were studied in nine Tourette patients during periods of rest, conversation, and video watching. In comparison with controls, the Tourette patients showed a significantly higher blink rate during rest and video watching. Conversation induced a significant increase in blink rate in the control group, but not in the Tourette patients, whereas video watching significantly increased blink rate in both groups. The frequency of eye tics showed a significant decrease during conversation and increased significantly during video watching in Tourette patients. In five patients, a significant positive correlation between blink rate and eye tic frequency was found, whereas one patient showed a significant negative correlation. Our results show that, even though some of our patients were on neuroleptic treatment, blink rate was about twofold to threefold increased versus healthy controls, suggesting increased central dopaminergic activity. Furthermore, these first quantitative data illustrate task specific effects on eye tic frequency and the complexity of their relation with eye blinks.

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Keywords: eye blinks; eye tics; Gilles de la Tourette's syndrome

Recurrent and involuntary motor and vocal tics constitute the typical characteristics of patients with the syndrome of Gilles de la Tourette.¹ Increased eye blinking is an often reported initial symptom of Tourette patients.^{1,2} Assessment of blink rate in Tourette patients can be of relevance because spontaneous blink rate is considered to be a useful non-invasive measure of central dopaminergic activity,^{3,4} which is assumed to play a part in the pathogenesis of Tourette's syndrome.¹ We know of only two reports on eye blinks in which quantitative data of Tourette patients are presented: Bonnett⁵ reported a threefold increase in blink rate (mean 54 blinks/minute) compared with controls (19), whereas Karson *et al*⁶ showed that mean blink rate in Tourette patients (20) did not differ from those of controls (19).

When evaluating spontaneous blink rate in Tourette's syndrome, these should be studied in relation to eye tics because these may interfere with eye blink rate. A positive correlation between blink rate and tics was reported by Karson *et al*,⁶ but they included all kinds of tics. Quantitative and descriptive data on eye tics in Tourette's syndrome are restricted to a few papers,^{7–10} but at present there are no quantitative studies available on eye tics and their relation to blinks.

We quantified eye blink rate and eye tics in Tourette patients during periods of rest, a conversation with the researcher, and watching a video with an amusing programme. Blinks and tics were quantified by means of an observational analysis from videotape.

Methods

Nine patients (seven men; mean age 37.6 years, range 20–56) with current symptoms of Tourette's syndrome were diagnosed by a senior psychiatrist (criteria DSM-IV¹¹). All patients had multiple and single motor and vocal tics, as well as obsessive compulsive behaviours, and scored mild to moderate on severity of the syndrome (Yale global tic severity scale¹²). Five of the nine patients were on neuroleptic drugs at the time of the study; one patient received an antidepressant. The control group consisted of 10 healthy volunteers (five men; mean age 33.8 years, range 18–61), unrelated to the patients. All subjects gave written informed consent to participate in the study; none wore corneal lenses.

Each subject participated in a session of about 1 hour during which she or he sat in a comfortable chair. A video camera recorded the movements of the face during: (a) rest1: a 10 minute period of rest, (b) a conversation of 5 minutes during which the subject talked with the researcher about his or her favourite hobbies, (c) rest2: a 5 minute period of rest, (d) watching a 15 minute video of an entertaining programme, and (e) rest3: a 5 minute period of rest.

The following definitions were used for (a) spontaneous eye blink: a bilateral paroxysmal closure of the eyelids (duration <1 s) in the absence of a provoking external stimulus, and (b) (eye) tics: a normal eye blink occurring at the same instant as a head movement, squeezing of the eyelids, rolling of the eyeballs, open-

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Table 1 Mean (SD) number of spontaneous eye blinks during rest and task periods, for the controls (n=10) and patients with Tourette's syndrome (n=9) separately

	Controls mean(SD)	Patients mean (SD)	Mann-Whitney U test Z values; p values
Rest1:			
min1	13.1 (15.8)	37.2 (9.3)	-3.35, 0.001
min4	13.1 (9.4)	33.6 (12.2)	-3.02, <0.01
Conversation:			
min1	26.5 (17.8)*	39.2 (18.6)	-1.39, NS
min4	23.8 (12.9)	42.2 (28.3)	-1.59, NS
Rest2:			
min1	15.6 (10.8)	35.0 (12.4)	-2.82, <0.01
min4	10.5 (7.7)	32.9 (11.4)	-3.28, 0.001
Video watching:			
min1	17.0 (7.9)**	43.2 (11.6)*	-3.51, <0.001
min4	16.4 (9.2)	44.7 (10.1)	-3.56, <0.001
Rest3:			
min1	18.4 (9.9)	37.7 (23.3)	-2.33, <0.05
min4	13.9 (11.7)	34.4 (18.7)	-2.58, 0.01

Min1=first minute; min4=fourth minute.

*Significant within group increase from rest, min4, to task, min1 (Wilcoxon test, p<0.05).

**Significant within group increase from rest2, min4, to video watching, min1 (Wilcoxon test, p=0.001).

ing the eyes wide, a combination of opening the eyelids wide and rolling of the eyeballs, and an uncertain category. Blinks and tics were quantified by means of the observer program (MS Windows version 4.0; Noldus, Wageningen, The Netherlands), a general purpose computer system for the collection and analysis of observational data. Blink rate and frequency of tics were summarised per 10 second periods and per 1 minute periods. An overall percentage of agreement between two observers of 96% was found for the number of blinks and 88% for the eye tics. Effects of the tasks on blinks and tics were analysed by Wilcoxon tests, for each group separately. Differences between patients and controls were evaluated by Mann-Whitney U tests. For each patient, relations between blinks and eye tics were studied by computing Spearman correlation coefficients. A p value <0.05 was used to indicate a significant difference or a significant correlation.

Results

CONTROLS

Conversation significantly increased blink rate, as did video watching (table 1). Blink rate remained increased during the first minute of rest after the tasks had finished. During the tasks, there was no significant difference between the blink rate of the first and fourth

minute, indicating a lack of habituation to the tasks (table 1).

PATIENTS

Conversation did not significantly increase blink rate, but video watching did (table 1). Similar to the controls, no habituation effects to the tasks were found and no significant decrease during the first minute of rest after the tasks had finished. Tourette patients showed a significantly higher blink rate than control subjects during all periods, with the exception of the conversation period (table 1). During conversation, the total number of eye tics decreased significantly versus the preceding rest period (table 2, p<0.05). Eye tic frequency during video watching increased significantly versus the preceding rest period (p=0.05), whereas after video watching eye tic frequency decreased again to baseline levels (p=0.05). Based on the overall data per subject, five patients showed a significant positive correlation between blink rate and eye tic frequency and one patient showed a significant negative correlation (table 2, last column).

Discussion

The increase in blink rate of the controls during a casual conversation has been reported before.¹³ Similar to conversation, we found an increase in blink rate during video watching in our control group. The simple attention demanding task of watching a video without speaking seemed to be enough to increase blink rate. The Tourette patients showed a twofold to threefold increase in blink rate versus the controls during periods of rest and video watching, similar to the findings of Bonnet,⁵ but contrary to those of Karson *et al.*⁶ Our eye tic findings illustrate that task responsivity of eye tics exists and that it is different from that of eye blinks: passively watching an amusing video stimulated both blink rate and eye tic rate, whereas active involvement in a conversation reduced eye tics without affecting blink rate. Perhaps the continuous change of visual stimuli during the video programme due to its lively character has contributed to the increase in blink and tic frequency. From clinical experience we have the impression that increased environmental

Table 2 For each Tourette patient, the mean number of blinks per minute and the mean total number of eye tics per minute and per condition

Patient	Rest1	Conv	Rest2	Video	Rest3	Spearman correlation (n=120)
	bl/m; tt/m	bl/m; tt/m	bl/m; tt/m	bl/m; tt/m	bl/m; tt/m	
1†	38.0; 8.8	36.8; 1.5	28.0; 5.3	29.5; 1.8	30.0; 3.5	0.15
2	41.3; 0.5	77.3; 0.5	40.3; 0.0	58.5; 0.0	67.0; 0.8	0.10
3‡	34.5; 12.3	42.8; 3.5	32.8; 3.8	47.8; 15.3	34.0; 9.0	-0.18*
4‡	20.3; 1.8	11.3; 0.3	14.5; 0.8	19.8; 2.5	11.3; 0.0	0.31***
5‡	32.5; 1.3	31.5; 0.0	31.3; 2.0	40.5; 5.3	24.3; 2.3	0.31***
6‡	40.5; 7.8	37.8; 2.0	46.8; 6.0	44.0; 9.8	29.5; 3.0	0.28**
7	37.3; 8.0	39.3; 8.0	32.0; 9.0	43.8; 24.3	40.5; 15.8	0.43***
8‡	26.3; 2.3	80.8; 3.0	41.3; 5.3	55.0; 6.8	39.8; 8.8	-0.02
9	21.3; 0.0	8.3; 0.0	28.8; 0.0	33.3; 6.0	36.5; 0.5	0.23**
Mean (SD)	32.4; 4.8 (8); (5)	40.7; 2.1* (25); (3)	32.9; 3.6 (9); (3)	41.4*; 8.0* (12); (8)	34.8; 4.9* (15); (5)	

Conv=conversation; bl/m=mean number of blinks/min; tt/m=mean total number of eye tics/min. †Patients treated with neuroleptics. ‡Patient treated with antidepressant. Per patient, Spearman rank correlation coefficients between the number of blinks and eye tics/10 s were computed for the whole recording (last column). Wilcoxon tests: within group change v preceding period: *p<0.05; Spearman rank correlation coefficients: *p<0.05; **p<0.01; ***p<0.001.

stimulation leads to increased tic frequency in Tourette's syndrome. Rebound effects on eye tics after the tasks were not found. Positive correlations between blink rate and eye tic frequency were seen in five patients, whereas one patient showed a significant negative correlation. However, when we looked at relations per rest or task period (data not presented), an even more complex pattern emerged, showing that: (1) usually there was no significant correlation between frequency of eye blinks and eye tics, (2) in some subjects a significant positive or negative correlation may occur, but (3) this is dependent on situational or cognitive requirements.

Increased central dopaminergic activity has been assumed to play a part in the pathogenesis of Tourette's syndrome.¹ Because spontaneous blink rate has been found to be a useful non-invasive measure of central dopaminergic activity,^{3,4} this implies that abnormalities in blink rate in Tourette's syndrome may reflect altered central dopaminergic dysfunction. In this study, five of the nine patients were treated with dopamine antagonists. Bonnett⁵ found a normalisation of blink frequency after neuroleptic treatment in Tourette patients, but Karson *et al*⁶ did not find a significant effect of pimozide on blink rate in their patients. Our results indicate that, even though some of our patients were on neuroleptic treatment, blink rate was about twofold to threefold increased versus healthy controls, suggesting increased central dopaminergic activity. Whether or not the frequency of eye tics was influenced by the neuroleptic medication could not be answered within the context of this study. Nevertheless, these first quantitative data illustrate task

specific effects on eye tic frequency and the complexity of their relation with spontaneous eye blinks. To further delineate the state dependency of relations between blinks and tics in Tourette's syndrome, more controlled studies are needed in which data are obtained from larger groups of patients before and during pharmacological or behavioural therapies.

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