**Abnormal Eye and Cranial Movements Triggered by Examination in People with Functional Neurological Disorder**

Tiago Teodoro1,2,3,4, Joana M Cunha1,3,5, Luis F Abreu1,3,4,6, Mahinda Yogarajah1,2, Mark J Edwards1,2

1. Neurosciences Research Centre, Molecular and Clinical Sciences Research Institute, St George’s, University of London, London, UK

2. Department of Neurology, St George’s University Hospitals NHS Foundation Trust, London, UK

3. Instituto de Medicina Molecular, Faculdade de Medicina, Universidade de Lisboa, Lisboa, Portugal

4. Serviço de Neurologia, Departamento de Neurociências, Hospital de Santa Maria, Lisboa, Portugal

5. Serviço de Psiquiatria, Departamento de Psiquiatria e Saúde Mental do Algarve - Centro Hospitalar Universitário do Algarve, Faro, Portugal

## 6. Instituto de Semiótica Clínica, Faculdade de Medicina, Universidade de Lisboa, Lisboa, Portugal

**Corresponding author:**

Mark J Edwards, FRCP, PhD

Eleanor Peel Professor of Neurology

St George’s, University of London & St George’s University Hospitals NHS Foundation Trust

Cranmer Terrace

London SW17 0RE

Email: [medwards@sgul.ac.uk](mailto:medwards@sgul.ac.uk)

**Abstract**

**Introduction**

Diagnosis of functional neurological disorder (FND) relies on the demonstration of positive symptoms and signs, as supported by recent changes in DSM5.

**Methods**

We prospectively recorded findings of routine clinical eye movement examination of consecutive new patients with a diagnosis of FND.

**Results**

101 consecutive patients were included. Most patients had a functional movement disorder. Clinical examination of eye movements triggered facial and eye movement abnormalities in 46% of patients with FND, all of which had clinical features typical of a functional disorder. Only 13% of patients complained of eye related symptoms prior to examination, and abnormalities were present in only 11% of patients during observation of cranial/eye movements outside of formal examination.

The most frequent abnormalities on formal assessment were excessive blinking (38.6%) and an effortful facial expression (26.7%). Other findings included increased latency of saccades (14.9%), functional tonic gaze deviation (13.9%) and convergence spasm (8.9%). Formal examination triggered new symptoms in 35 (34.7%) patients, most frequently dizziness (26.7%), pain (8.9%) and blurred vision (7.9%).

**Conclusion**

Formal eye movement examination of patients with FND frequently triggers abnormal facial and eye movements and associated symptoms. These facial and eye movements have characteristics (distractibility, incongruity) associated with functional movement disorders. The emergence of abnormalities such as these during examination is therefore a useful supporting feature suggesting the diagnosis of FND. It also links well to pathophysiological models of FND which emphasise the importance of abnormal self-directed attention in the production of functional movement abnormalities.

**Key Words**

Functional Neurological Disorder; Functional Movement Disorder; Eye movements;

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**Disclose statement**

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**Introduction**

A key feature of functional neurological disorder (FND), particularly evident in those with functional movement disorders, is the negative impact of attention towards the body or towards movement, for example during physical examination. This is well illustrated by Hoover’s sign: hip extension is weak when deliberately attempted upon request, but is normal when triggered automatically by contralateral hip flexion. Such signs, amongst other symptoms and signs, form the basis for a positive diagnosis of FND, moving away from a diagnosis of exclusion (“it must be FND because all tests are normal”) or a diagnosis made on the basis of co-morbidities (“it must be FND because the patient has experienced trauma”).

We have frequently observed the emergence of new symptoms and signs seemingly triggered by the act of neurological examination, and had the impression that these were most commonly seen when assessing eye movements. Functional eye and facial movement disorders can present, either as an isolated disorder or as a part of a cluster of functional neurological symptoms. 1 2 The concept of a “casual eye movement examination” has been put forward to aid categorization of eye movement disorders as functional or not – here abnormalities are present on direct examination, but normalize (perhaps just transiently) while the patient is observed during history taking or other tasks.

A retrospective review of a cohort attending neuro-otology clinics reported functional eye movement disorders in 1-4% of patients.3 They highlighted the frequent coexistence of functional eye movement disorder with other forms of FMD. Another retrospective study reported coexisting functional eye movement disorder in 6% of a cohort of patients with FMD.4

Here we report a consecutive case series relating to the prevalence and phenomenology of “examination-triggered” eye and cranial movement disorders in people with FND.

**Methods**

We prospectively recorded visual symptoms and findings on eye movement examination of consecutive new patients attending the Functional Neurological Disorders clinical service at St George’s University Hospitals. Given the nature of our clinics (linked closely to the movement disorders team) the majority of the patients had a functional movement disorder.

The data were collected as part of routine clinical assessment, which includes casual observation of eye movement during consultation and formal examination of saccades, smooth pursuit and vergence, and therefore this project was not subjected to ethical committee review.

We excluded follow-up patients and those patients with other conditions known to cause abnormalities on eye movement examination. We only included new patients with a final diagnosis of a Functional Neurological Disorder.5

**Results**

We collected data from 108 consecutive new patients diagnosed with FND from our joint clinics (ME, TT and MY).

We included 101 patients in our final analysis. Seven patients were excluded because an FND diagnosis was not sufficiently certain (below the level of clinically definite5) (2 patients) or because they had coexisting neurological disorders known to cause eye movement abnormalities (5 patients).

The median age was 40 [interquartile range 31-51]. There were 76 females (75.3%).

A form of FMD was present in 92.1% patients, non-epileptic attacks (NEA) in 16.8%, functional sensory symptoms in another 16.8% and a primary complaint of functional cognitive symptoms in 7.9% (Supplementary Materials).

A coexisting psychiatric diagnosis was present in 38.6% [such as anxiety (24.8%)or depression 27.7%)]. Chronic/recurrent pain of any type was present in 68.3% and fatigue in 40.6% patients (Supplementary Materials).

**Visual symptoms** were reported by 12.9% patients before formal examination, including blurred vision in 12.9% and double vision in 5%.

On “**casual” observation** before formal examination only 10.9% showed abnormal eye movements, consisting in oscillatory eye movements in 3% (including one case of functional opsoclonus) and increased eye blinking in 7.9%. In all of these cases there were associated features supporting a diagnosis of a functional eye movement or cranial movement disorder, including distractibility elicited by additional maneuvers.

In contrast to casual observation, **formal neurological examination** detected eye movement abnormalities in 45.5% patients. Saccades were abnormal in 42.6% and smooth pursuit movement in 36.6%.

Effortful facial expression and other responses (e.g. frowning, grimacing, effortful breathing) (26.7%) and/or excessive blinking (38.6%) predominated, with at least one of them being present in 40.6% patients of our cohort. They were the most frequent abnormalities during the assessment of saccadic and smooth pursuit movements (Table I). Other relatively common abnormalities (≥ 10%) included increased latency of saccades (14.9%) and tonic gaze deviation (13.9%).

Formal eye movement examination also triggered new *symptoms* in 34.7%, most frequently dizziness (26.7%), pain (8.9%) or blurred vision (7.9%).

Finally, we dichotomized our cohort according with the presence/absence of abnormal eye and cranial movements triggered by examination. After correcting for multiple comparisons (Bonferroni), none of the differences in demographics, FND manifestations and comorbidities was significant (Supplementary Materials).

**Discussion**

We found that functional eye movement and facial movement abnormalities were common in a group of 101 consecutive patients with FND (46%), most of whom had a functional movement disorder affecting limbs or gait. Importantly, the rate of eye/facial movement symptoms reported by patients was relatively low (13%) as was the rate of eye/facial movement signs seen during “casual” observation (16%). Thus, we found a prominent triggering of new symptoms and signs affecting the eyes and face via the act of physical examination. These included an effortful facial expression during eye movements, tonic gaze deviation, saccadic delay or convergence spasm, amongst others.

We suggest that these findings are useful on both a clinical and pathophysiological level. Clinically the contrast between findings on casual observation and formal examination provides evidence for internal inconsistency, which is a defining feature of FND. Furthermore, it is important for clinicians to be aware of this phenomenon, and not to misinterpret it as a sign of an “organic” eye movement disorder, hence distracting from the diagnosis of FND. This issue highlights the importance of the casual eye movement (and in fact casual general) examination in diagnosis of FND. This can take additional time in the consultation, but can provide essential positive findings to help improve diagnostic confidence in FND.

Pathophysiologically, the triggering of new symptoms and signs through physical examination fits very well with the central role for attentional diversion towards the body and towards the “mechanics” of movement proposed in pathophysiological models of FND. The effortful nature of performance of quite simple tasks in physical examination was a common feature of many of the eye and cranial movement problems we saw in our cohort. We often observe an effortful facial expression when patients with FMD perform other seemingly simple motor tasks upon request, such as finger tapping. We relate this excessive effort during deliberate task performance with an abnormal “attentive” mode of motor control where attention is directed towards movement mechanics and away from its goal. Significantly, in cognitive processes, a *controlled* operational mode requires more effort than an *automatic* operational mode.6 This links to other clinical signs that have been reported in FMD, for example the “huffing and puffing” sign in some people with functional gait disorder.7

Functional tonic gaze deviation was present in 13.9% of our cohort. This is higher than the frequency of 3.8% reported by a retrospective study of a cohort with FMD.4 Functional tonic gaze deviation (functional oculogyric crisis) is proposed to describe a sustained (usually upward) gaze that is distractible but not suppressible by volition. In contrast, in organic oculogyric crisis gaze always deviates upwards and it is suppressible by volition.1 In our cohort, tonic gaze deviation was always triggered by formal movement examination: saccadic or smooth pursuit movements performed upon request were followed by a sustained ocular version in the same gaze direction (not only upwards).

Convergence spasm has been previously reported as the most frequent functional eye movement disorder.2 This is driven by a previous small study that found this abnormality in 9 out of 13 patients with FMD.8 However, its frequency was far lower in our cohort, only affecting 8.9% patients. This was within the same range of other eye movement abnormalities such as increased latency of saccades (14.9%) and tonic gaze deviation (13.9%) and far lower than excessive blinking (38.6%).

We would like to end by acknowledging several methodological limitations. Most importantly, this is an uncontrolled study. Secondly, we analysed a cohort of patients from a specialist FND clinic, and therefore our patients are probably more severely affected than patients with FND seen in other clinical settings. The majority of our cohort had some form of FMD (92.1%). This limits the generalizability of our findings to people with other manifestations of FND. The clinical phenomena that we reported were rated during normal clinical examination and were not rated off-line by independent raters. This may have produced a bias which in a future study could be improved by using a more standardized rating system. Finally, our findings on clinical observation warrant further characterization with formal quantitative oculomotor assessment.

In conclusion, we found functional eye and cranial movement disorders to be frequent in cohort of patients with FND. Formal eye movement examination triggered a specific array of objective abnormalities and associated symptoms, which were not associated with reported symptoms prior to examination and which were absent in most patients during casual observation.

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**Table I – Abnormalities detected on formal eye movement examination of patients with FND**

|  |  |
| --- | --- |
| Saccadic Eye Movement Assessment | Number (%)\* |
| Any Abnormality | **43 (42.6%)** |
| *Excessive blinking* | 37 (36.6%) |
| *Effortful facial expression* | 24 (23.8%) |
| *Increased latency* | 15 (14.9%) |
| *Tonic gaze deviation* | 11 (10.9%) |
| *Limited range* | 2 (2%) |
| *Absent frontalis corrugation on attempted upgaze* | 2 (2%) |
| *Other* | 7 (6.9%) |
| Smooth Pursuit Assessment |  |
| Any Abnormality | **37 (36.6%)** |
| *Excessive blinking* | 28 (27.2%) |
| *Effortful facial expression* | 19 (18.8%) |
| *Tonic gaze deviation* | 10 (9.9%) |
| *Gaze distractibility / impersistence* | 7 (6.9%) |
| *Limited range* | 3 (3%) |
| *Absent frontalis corrugation on attempted upgaze* | 1 (1%) |
| *Other* | 4 (4%) |
| Other eye movement abnormalities |  |
| Any | **10 (9.9%)** |
| *Convergence spasm* | 9 (8.9%) |
| *Functional opsoclonus* | 1 (1%) |
| Symptoms triggered by eye movement examination |  |
| Any | **35 (34.7 %)** |
| *Dizziness* | 27 (26.7%) |
| *Pain* | 9 (8.9%) |
| *Blurry vision* | 8 (7.9%) |
| *Double vision* | 2 (2%) |
| *Tinnitus* | 1 (1%) |
| *Worsening of eye blinking* | 1 (1%) |
| *Worsening of functional opsoclonus* | 1 (1%) |

(\*)\_All percentages are relative to the whole cohort of 101 patients.