



## Lower limb motor restlessness in Asperger's disorder, measured using actometry

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### Abstract

The movement disturbances and brain imaging findings in Asperger's disorder (AD) suggest a dopaminergic deficit in movement regulation. Movement disorders of different etiologies have been quantified and specified with actometry. We compared 10 AD patients with 10 healthy controls, measuring their rest-activities by actometry. The lower limb motor activity was significantly higher in the AD group. They also displayed a rhythmic, periodic movement pattern similar to akathisia. These findings suggest a hypothesis of idiopathic akathisia and a special sensitivity to adverse effects of neuroleptic drugs.

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### 1. Introduction

Asperger's disorder (AD) is a disorder in the autism spectrum. This new diagnostic concept, still under some debate (Volkmar et al., 2000), indicates a syndrome characterized by behavioral features typical of autism in the absence of significant deficits of cognitive functioning (American Psychiatric Association, 2000). Hypodopaminergia in autism (Ernst et al., 1997) may lead to secondary dopaminergic hypersen-

sitivity (Segawa and Nomura, 1992). The dopaminergic dysfunction and the structural abnormalities in the basal ganglia (Jacobson et al., 1988) may explain the presumed neuroleptic intolerance in autistic patients (Scahill and Koenig, 1999) and the primary motor abnormalities (Leary and Hill, 1996).

Movement disorders are common in AD, manifesting clinically as clumsiness (Gillberg, 1995; Smith, 2000; Weimer et al., 2001), a lack of motor coordination (Miyahara et al., 1997), and stereotypic, repetitive movements (Ringman and Jankovic, 2000). Furthermore, AD patients may suffer from other motor disorders associated with comorbid disorders such as Tourette's syndrome (TS) (Kadesjö and Gill-

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berg, 2000) and attention deficit hyperactivity disorder (ADHD) (Ghaziuddin et al., 1998). Both TS and ADHD are characterized by motor symptoms and show some evidence of dopaminergic dysregulation and striatal dysfunction (Malison et al., 1995; Seeman and Madras, 1998; Thapar et al., 1999, Sheppard et al., 2000).

Actometry (actigraphy) is a direct method for measuring motor activity both quantitatively and qualitatively, developed from accelerometry. Although validated for sleep-studies (Sadeh et al., 1989), it has been increasingly used in neuropsychiatry to record day time motor activity (Teicher, 1995) in ADHD subtypes (Porrino et al., 1983; Dane et al., 2000), antisocial personality disorder (Virkkunen et al., 1994), and neuroleptic-induced movement disorders (Poyurovsky et al., 2000), for example. Multi-channel movement recording offers new opportunities to specify extrapyramidal movement disorders (Foerster and Smeja, 1999; Tuisku et al., 1999).

We hypothesized that lower limb motor activity may be abnormal in AD, in view of the susceptibility to movement disorders, comorbidity aspects and the evident dopaminergic dysfunction in infantile autism. Moreover, we wanted to determine whether motor symptoms related to hypodopaminergia, such as akathisia or RLS (Turjanski et al., 1999), would appear. Both akathisia and RLS demonstrate increased motor activity during rest (Montplaisir et al., 1998; Tuisku et al., 1999) and a specific actometric movement pattern (Kazenwadel et al., 1995; Collado-Seidel et al., 1999; Tuisku et al., 1999).

To test our hypothesis, we performed three-channel actometry for the quantitative and qualitative assessment of rest activity in AD. We wanted to compare the AD movement indices and the movement patterns with the normal rest activity of healthy controls.

## 2. Methods

### 2.1. Subjects

Ten individuals with AD, seven males and three females, aged 21–44 years (mean 29.8, S.D. 8.0), were recruited from the Helsinki Asperger Center. The inclusion criteria were an age of 18–65 years and the diagnosis of AD according to DSM-IV (American

Psychiatric Association, 2000). The exclusion criteria were major somatic diseases, a past or present psychosis, current substance abuse and current psychopharmacological treatment. All the subjects were unmedicated except one, who had been on stabilized thyroxine substitution since childhood. The minimum washout period for benzodiazepine-like hypnotics and melatonin was 2 weeks, while it was 3 months for antidepressant drugs and 1 year for neuroleptic drugs. None of the subjects had used hypnotics regularly, and none of them had had long-term neuroleptic exposure.

Somatic disorders were ruled out by clinical examination and laboratory tests, including electrocardiogram, serum glucose, sodium, potassium, phosphorus, calcium, creatinine, glutamyl transferase, thyroxine, thyroid-stimulating hormone, prolactin, aminotransferases, C-reactive protein, ferritin, blood sediment, complete blood cell count and urine screen. Past or present psychosis was excluded by a structured diagnostic interview, the SCID (Spitzer et al., 1989).

Ten age- and sex-matched healthy, unmedicated controls aged between 23 and 47 (mean 30.8, S.D. 8.8) were recruited from the hospital staff. Informed consent was obtained from all the subjects and the study was approved by the ethics committee at Helsinki University Central Hospital.

### 2.2. Procedures

We used three-channel actometry to measure the lower limb activity and ankle–waist ratio during controlled rest. “Controlled rest activity” is a parameter of motor activity in a situation where sitting still is adequate and expected but not instructed, or required. The controlled situation was created by a neutral, medical interview (Tuisku et al., 1999, 2000). The actometers were attached to the waist and ankles of the subjects. Actometric recording was performed on all the subjects while sitting in the interview for 30 min.

The actometric monitors we used are small, computerized movement detectors (type PAM3, IM-systems, Baltimore, MD, USA), which do not affect the normal movement of the subject. They contain triaxial piezoelectric accelerometer sensors, which react to acceleration rates above 0.1 G. The recorded acceleration signal is sampled as an activity count at a rate of 40 Hz, and the values for each sample are used to calculate the average activity counts within a chosen time win-

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