



## Research paper

## Cognitive behavioral therapy is effective in misophonia: An open trial

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## ABSTRACT

**Background:** Misophonia is a psychiatric disorder in which ordinary human sounds like smacking or chewing provoke intense anger and disgust. Despite the high burden of this condition, to date there is no evidence-based treatment available. In this study we evaluated the efficacy of cognitive behavioral therapy (CBT) and investigated whether clinical or demographic characteristics predicted treatment response.

**Methods:** Ninety patients with misophonia received eight bi-weekly group CBT sessions. Treatment response was defined as a Clinical Global Impression – Improvement Scale (CGI-I) score at endpoint of 1 or 2 (very much or much improved) and a 30% or greater reduction on the Amsterdam Misophonia Scale (A-MISO-S), a measure of the severity of misophonia symptoms.

**Results:** Following treatment 48% (N=42) of the patients showed a significant reduction of misophonia symptoms. Severity of misophonia and the presence of disgust were positive predictors of treatment response.

**Limitations:** The A-MISO-S is not a validated scale. Furthermore, this was an open-label study with a waiting list control condition.

**Conclusions:** This is the first treatment study for misophonia. Our results suggest that CBT is effective in half of the patients.

## 1. Introduction

Misophonia is a psychiatric disorder, characterized by intense anger and disgust, which are triggered when patients are confronted with particular human sounds such as smacking, chewing, loud breathing, or typing. These sounds provoke agitation and impulsive aggression, which causes patients to avoid situations with possible misophonic triggers (Schröder et al., 2013). For instance, meals with other people, use of public transport or work related meetings are avoided. If situations cannot be evaded they are endured with intense suffering. The suffering and avoidance lead to major social and occupational impairment.

Misophonia is a new disorder and research into this field has only recently been emerging. The etiology of misophonia remains unknown. Patients with misophonia generally have normal hearing and misophonic reactions are not related to hearing thresholds (Schröder et al., 2013; Schröder et al., 2014; Jastreboff and Jastreboff, 2015). Therefore, misophonic reactions are thought to be due to increased connectivity between auditory and limbic brain regions (Cavanna and Seri, 2015; Jastreboff and Jastreboff, 2015). Furthermore, it has been associated with various psychiatric conditions, such as Tourette's syndrome and obsessive-compulsive personality disorder, suggesting a shared etiology

(Cavanna and Seri, 2015; Webber et al., 2013; Schröder et al., 2013).

Because of its novelty, misophonia incidence and prevalence rates are still speculative. In an online survey amongst students (N=483) 20% reported significant misophonic symptoms (Wu et al., 2014), with the respondents primarily being comprised of female undergraduates and lacking psychiatric evaluation, therefore limiting generalizability. Based on data from an audiology clinic, it has been estimated that misophonia symptoms in the general population could be as high as 3.2% (Jastreboff and Jastreboff, 2014). However, the authors did not reveal how diagnosis was established, also reducing generalizability. Nevertheless, in just five years nearly 500 patients have been referred to our institute. This further suggests that misophonia is a hidden epidemic. Hence there is tremendous need for effective treatment.

Currently there is no evidence-based treatment available. Even though beneficial effects have been reported in patients treated at an audiology clinic, interpretation is limited due to an absence of a valid assessment method for diagnosis, symptom severity and improvement (Jastreboff and Jastreboff, 2014). Interestingly, positive results have been described in six cases, who were treated with cognitive behavioral therapy (CBT) (Bernstein et al., 2013; Dozier, 2015a, 2015b; McGuire et al., 2015; Reid et al., 2016). CBT techniques were also applied in a pilot study at our institute. In this unpublished study seven patients

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**Table 1**  
Clinical and demographic characteristics (N = 90).

Male (N, %)	25 (28%)
Age at T0 (Mean, SD)	35.8 (12.2)
Age of onset (Mean, SD)	12.5 (4.8)
Duration of symptoms in years (Mean, SD)	23.2 (12.6)
Time until treatment in weeks (Mean, SD)	29.0 (15.5)
Comorbidity (N, %)	
Skinpicking disorder	5 (5.5)
ADHD	4 (4.4)
Obsessive-compulsive disorder	3 (3.3)
Hypochondria	1 (1.1)
Bulimia/anorexia	3 (3.3)
Tourette syndrome	2 (2.2)
Body dysmorphic disorder	1 (1.1)
Bipolar II disorder	1 (1.1)
Dysthymic disorder	2 (2.2)
Depressive disorder	1 (1.1)
Misophonia symptom characteristics	46 (51%)
Irritability by ambient sounds (N, %)	
Most triggering sound (N, %)	
Eating sounds	69 (77%)
Triggered emotion (N, %)	
Anger	57 (63%)
Anger + disgust	33 (37%)
Measures	
A-MISO-S* T0 (Mean, SD)	13.6 (2.9)
SCL-90** T0 (Mean, SD)	163.4 (47.4)
A-MISO-S T2 (Mean, SD)	9.1 (3.9)
A-MISO-S change T0-T1 (Mean, SD)	.0 (2.6)
A-MISO-S change T1-T2 (Mean, SD)	-4.5 (3.5)
Responder*** (N, %)	42 (48%)

\* A-MISO-S = Amsterdam Misophonia Scale.

\*\* SCL-90 = Symptom Checklist-90 (N = 86).

\*\*\* Responder was defined as a Clinical Global Impression-Improvement (CGI-I) score of 1 or 2 and A-MISO-S decrease  $\geq$  30%; CGI-I (N = 88).

showed promising improvement following bi-weekly group CBT. We therefore decided to determine the efficacy of group CBT in a larger study. Additionally, to add to our current knowledge on misophonia and the effect of CBT, we investigated if clinical and demographic factors predicted treatment response.

## 2. Methods

### 2.1. Subjects

Ninety patients (65 women, 25 men) referred because of misophonia were included. They visited the outpatient clinic at the department of psychiatry at the AMC between April 2012 and November 2013. Exclusion criteria were the presence of substance dependence, bipolar disorder, autism spectrum disorders or psychotic disorders. The study was carried out in accordance with the Declaration of Helsinki and was approved by the AMC medical ethics committee. All patients provided informed consent. Table 1 presents clinical and demographic characteristics.

### 2.2. Procedure

To ensure that patients met the diagnostic criteria for misophonia, psychiatrists experienced in obsessive-compulsive and related disorders screened all patients. Patients completed the Symptom Checklist-90 (SCL-90) (Arrindell and Ettema, 1986; Derogatis et al., 1973) before the interview at the outpatient clinic (T0). At the interview, the Amsterdam-Misophonia-Scale (A-MISO-S) (Schröder et al., 2013) was administered by a trained psychiatry resident. Because we consider anger and disgust the core emotions triggered in misophonia, we explicitly asked whether misophonic sounds elicited anger and/or disgust.

Following the interview, patients were put on a waiting list before entering the group CBT program. Participation in the CBT program (T1) started at an average of 29.0 weeks (SD 15.5, range 5–79) after the interview. At T1 and again at the end of the group CBT (T2), the A-MISO-S was administered by the therapists. The Clinical Global Impression – Improvement Scale (CGI-I) (Guy, 1976) was completed by the therapists at T2. Finally, after T2 patients filled out post-treatment evaluations forms.

### 2.3. Measures

Symptom severity was measured with the A-MISO-S, a concept scale based on our previous descriptive study of 42 misophonia patients (Schröder et al., 2013). Quantitative scores - ranging from 0 to 24 - were used for clinical reference. Scores from 0 to 4 are considered subclinical misophonic symptoms, 5–9 mild, 10–14 moderate, 15–19 severe, 20–24 extreme.

Therapists filled out the CGI-I (Guy, 1976), a 7-point likert scale that assesses how much the patient has clinically improved or worsened, after treatment (1 = very much improved; 2 = much improved; 3 = minimally improved; 4 = no change; 5 = minimally worse; 6 = much worse; or 7 = very much worse).

General mental and physical dysfunctioning was assessed with the Dutch version of the SCL-90 (Arrindell and Ettema, 1986; Derogatis et al., 1973) a validated self-report questionnaire. The total score of the SCL-90 is considered a general index of psychopathology.

A quantitative measure of treatment response was defined by change in A-MISO-S scores from T1 (start of CBT) to T2 (end of CBT). A binary measure of treatment response was defined as obtaining both a CGI-I score of 1 or 2 (very much or much improved) and a 30% A-MISO-S score reduction after treatment (T2) in relation to the baseline A-MISO-S (T1) score. A 30% reduction is a commonly used definition of response in psychiatric treatment (Koran et al., 2002; Philips et al., 1997; Rabinowitz et al., 2008).

In addition to the aforementioned questionnaires, misophonia symptoms were categorized as follows: triggered emotion was dichotomized into “anger” and “anger with disgust” because not all patients experience disgust (with “anger” as the reference category) (Schröder et al., 2013); presence of irritability due to ambient sounds was also dichotomized into “yes” and “no”; duration of symptoms and age of onset were described in years.

Post-treatment evaluation forms included general questions about the therapy (directions, duration, frequency) and specific questions about the different CBT techniques (e.g. which technique was (not) helpful in decreasing symptoms and how it (not) helped them). Patients were encouraged to illustrate these with personal examples.

### 2.4. Treatment

In our misophonia model the core symptoms consist of both a hyper focus on human sounds and an immediately triggered negative affective reaction. The increased focus on misophonic triggers could be due to impaired attentional control, while the immediate negative affective reaction could be related to increased irritability levels. Importantly, in the development of the unpublished pilot study we noticed that mere exposure to misophonic triggers did not decrease symptoms. Mostly, it even increased misophonia symptoms. Therefore, in the current treatment protocol we addressed the two core symptoms with four different techniques that were also used in the pilot study: task concentration exercises, counterconditioning, stimulus manipulation, and relaxation exercises.

Task concentration exercises can be used to improve attentional shifting (Mulken et al., 1997), addressing the core symptom of attentional bias. Attentional bias implies that a stimulus that is emotionally salient to a person, e.g. the sound of someone eating, draws his or her attention. With these exercises patients learn to focus

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