ARTICLE TITLE

Treatment of Misophonia

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DISCLOSURE STATEMENT

The authors have nothing to disclose

KEY WORDS

Misophonia, treatment, psychotherapy, Unified Protocol, Process-Based Therapy, multi-disciplinary treatment

KEY POINTS

1) Introduces misophonia and reviews published psychotherapy treatment studies
2) Outlines a multi-disciplinary strategy for treatment
3) Describes the application of two transdiagnostic psychotherapies (Unified Protocol and Process-Based Therapy)
4) Suggests an agenda for future research and treatment development

SYNOPSIS

Misophonia is a newly defined sound intolerance disorder characterized by strong multi-modal emotional responses to aversive repetitive auditory cues and associated stimuli. This prototypically features highly unpleasant physiological, cognitive, and behavioral responses elicited by oral or facial cues (but can include other sounds) made by others (e.g., chewing, throat-clearing). Symptoms range in severity and level of impairment. Most treatments explored to date have used cognitive behavioral psychotherapies in small case studies, with three open trials and one randomized controlled trial. No specific treatments are recommended at this time for all people with misophonia. Instead, we recommend a multi-disciplinary treatment strategy with audiology, occupational therapy, and mental health

clinicians. Psychotherapies that are evidence-based and transdiagnostic such as the Unified Protocol or a more flexible Process-Based Therapy framework are recommended for future study. A research agenda is recommended, including studies that investigate (a) underlying mechanistic targets for change in misophonia, (b) the nature of misophonia cross-culturally and in diverse individuals, (c) multi-disciplinary treatment models, (d) the effects of scalable interventions using support and psychoeducation, and (e) digital health interventions.

CLINICS CARE POINTS

- Misophonia symptoms can occur with or without psychiatric disorders or other health problems. Start treatment with a multi-disciplinary strategy of evaluations and treatment recommendations across audiology, occupational therapy, and mental health providers.
- There are no cures, medications or proven treatments for misophonia. Aim to enhance functioning using interventions known to impact primary processes underlying problematic patterns (physiological arousal, attention, cognition, behavior, communication).
- When considering mental health treatments, seek transdiagnostic evidence-based therapies (e.g., Unified Protocol) and flexible frameworks leveraging evidence-based change process to tailor interventions to the individual (e.g., Process-Based Therapy).
- Habituation-based exposure therapy is not indicated, but inhibitory learning models of exposure therapy may be helpful as part of a broader treatment approach.

Treatment of Misophonia

Misophonia was recently defined as a disorder characterized by intolerance of specific auditory stimuli and associated cues causing significant psychological distress and interference in social, occupational, or academic functioning (Swedo et al., 2022). Aversive stimuli in this context may be labeled as "triggers" that are commonly repetitive sounds produced by others. Primary triggering stimuli in misophonia most often (but not always) originate from facial (e.g., nose noises, throat clearing) or oral (e.g., lip smacking, chewing, drinking) sources. However, there are individual differences in the types of cues and contexts (e.g., the same sound may have different effects when produced by specific people) associated with misophonia symptoms (see Brout et al., 2018; Potgieter et al., 2019).

Individuals with impairing levels of misophonia symptoms may have strong multi-modal emotional responses to contexts in which triggering cues are anticipated or encountered. For example, common responses include: central (e.g., insula; Kumar et al., 2017) and peripheral nervous system activation (e.g., increased heart rate and skin conductance; Edelstein et al., 2013), negative affect (e.g., irritation, anger, anxiety, disgust; Remmert et al., 2022; Rosenthal et al., 2021), and behavioral patterns that can be conceptualized (Rosenthal et al., 2022) as consistent with freeze (e.g., hypervigilance), flight (e.g., escape or avoidance behavior), and fight behaviors (e.g., interpersonally aggressive verbal behavior). These responses are highly distressing and different than how most others might react (for a review, see Swedo et al., 2022).

Jastreboff and Jastreboff (2001) are credited for coining the term misophonia over 20 years ago. The term translates to hatred or dislike (miso) of sound (phonia). However, this literal translation is misleading, as the condition is neither uniquely associated with the affective experience of hate or dislike, nor are auditory cues the only stimuli that can function as triggers. The first pilot studies directly examining misophonia were published only nine

years ago (Edelstein et al, 2013; Schröder et al, 2013). Since then, over 60 published empirical studies have investigated misophonia, with roughly 25% of these published over the last year in the first special section in a peer-reviewed scientific journal dedicated to misophonia (*Frontiers in Neuroscience*).

Recent reviews suggest that misophonia may be associated with a wide variety of mental health problems (Brout et al., 2018; Potgeiter et al., 2019; Swedo et al., 2022). The majority of studies have used self-report methodologies and have found that misophonia symptom severity is positively correlated transdiagnostically with, for example, neuroticism, anxiety symptoms, depressive symptoms, difficulties with emotion regulation, affective instability, anxiety sensitivity, some obsessive compulsive disorder (OCD) symptoms, perfectionism, and somatic pain (Cassiello-Robbins et al., 2021; Cuasck et al., 2018; Guetta et al., 2022; Jager et al., 2020; McKay et al., 2018; Quek et al., 2018; Rouw & Erfanian, 2018; Siepsiak et al, 2020; Wu et al., 2014). Additionally, adults with misophonia may be significantly more likely than those without misophonia to self-report a lifetime history of attention deficit/hyperactivity disorder (ADHD), OCD, bipolar disorder, substance use disorder, post-traumatic stress disorder (PTSD), and conversion disorder (Kılıç et al, 2021; Rouw & Erfanian, 2018).

Two recent studies have used structured psychiatric diagnostic interviews as a more rigorous approach to the assessment of misophonia and associated mental health problems. In one study, 575 adults presenting for treatment at a clinic in Amsterdam were interviewed using the Mini International Neuropsychiatric Interview (M.I.N.I.; Sheehan et al., 1998), a structured interview assessing 15 current psychiatric problems (Jager et al., 2020a). Results indicated that most (72%) participants did not meet full criteria for a current psychiatric disorder. The most common current disorders were mood disorders (10.1%), anxiety disorders (9%), ADHD (5.4%), and personality disorders (5%).

Rosenthal et al. (2022) conducted the first study to characterize DSM-5 disorders using structured diagnostic interviews in a sample of 207 adults with high misophonia symptoms. Results indicated that anxiety disorders were the most common type of current mental health problem (56.9%). Additionally, high rates of lifetime history of psychiatric disorders were observed, including diagnoses of any anxiety (73%), mood (61%), obsessive-compulsive (27%), substance use (26%), trauma-related (24%), eating (18%), or personality disorders (13%).

The findings from Jager et al. (2020a) suggest that most adults seeking outpatient treatment for misophonia in Amsterdam may not have a current psychiatric disorder. In contrast, results from Rosenthal et al. (2022) indicate that adults across the United States with high misophonia symptoms may be most likely to meet full criteria for a current anxiety disorder or lifetime history of any anxiety or mood disorders. A consistent interpretation of findings across all studies is that higher misophonia symptoms do not appear to be uniquely related to any specific psychiatric disorder. Accordingly, it is premature to conclude that any specific treatment protocol for any specific psychiatric disorder is best for the treatment of misophonia.

Treatment of Misophonia

Multi-disciplinary model: Audiology. There is no gold standard evidence-based treatment for misophonia, and it is not a disorder within the purview of any specific clinical discipline. Because it appears to be a problem at the intersection of various clinical fields, a multi-disciplinary treatment model may be valuable. For example, audiologists may be important to feature in the assessment and treatment of misophonia since it is defined as a sound intolerance condition. Because misophonia may need to be differentiated with hyperacusis, audiologists may be helpful in assessment and treatment planning. For example,

audiologists use evaluative measures to assess sensitivity thresholds, and can discern if one is hypersensitive to auditory stimuli.

With regard to treatment, audiologists can work with patients to determine the pros and cons of using sound-based therapies. These approaches use patient-controlled devices unobtrusively placed in the ear canal to diminish (e.g., noise cancellation), mask (e.g., static brown or white noise), and change responses to auditory input. Although these interventions have not been tested empirically using randomized trials for the treatment of misophonia, promising support has come from clinical observations reported by Jastreboff and Jastreboff (2014), who pioneered the adaptation of Tinnitus Retraining Therapy for patients with misophonia and report high rates of success in uncontrolled trials. This approach uses sound therapy and behavioral training to change response patterns to triggering contexts and cues, and was reported by the developers to be highly effective in a clinical setting.

Multi-disciplinary model: Occupational Therapy. Because misophonia may occur in the context of multi-sensory over-responsivity, it may be valuable to include occupational therapists in a multi-disciplinary assessment and treatment approach. Occupational therapists emphasize improvement of functioning across key domains of life. Because occupational therapists are the experts in sensory processing within healthcare, they may offer helpful coping strategies to manage misophonia effectively. Occupational therapy includes treatments designed to help improve central sensory processing through interventions designed to enhance sensory integration functioning. Treatments may identify and intervene upon environmental barriers to adaptive sensory processing or train new adaptive reactions to emotionally evocative sensory cues. Like approaches used by audiologists, there are no randomized controlled trials evaluating the efficacy of occupational therapy interventions with misophonia. However, these interventions have a long history of being used to improve sensory processing, and, as such, may be worth considering for those with misophonia.

Multi-disciplinary model: Mental health. Some early clinical observations (Jastreboff and Jastreboff, 2014) and the large study by Jager et al. (2020a) indicate that adults with misophonia may present for treatment without co-occurring psychiatric disorders. On the other hand, there is a growing body of research and clinical observations pointing to misophonia occurring in the context of varied and debilitating psychiatric disorders (e.g., Rosenthal et al., 2022) and an associated need for mental health professionals to be involved in treatment of this disorder. Accordingly, evaluation and treatment recommendations from mental health providers are indicated in a multi-disciplinary model of care for misophonia.

Treatment Studies. Most publications describing possible psychotherapies for misophonia have been small case studies (Altınöz et al., 2018; Bernstein et al., 2013; Cowan & Marks, 2022; Dover et al., 2021; Dozier, 2015a, 2015b; Kamody & Del Conte, 2017; Lewin et al., 2021; McGuire et al., 2015; Muller et al., 2018; Petersen & Twohig, 2022; Reid et al., 2016; Schneider & Arch, 2017; See Table 1). These treatments were mostly conducted using branded (e.g., acceptance and commitment therapy; ACT) and non-branded interventions from the family of cognitive behavioral therapies (CBTs), and the authors reported descriptions of successful treatment in one or several individuals.

Examples of non-branded interventions include cognitive restructuring (i.e., Altınöz et al., 2018; Bernstein et al., 2013; Dover et al., 2021; Lewin et al., 2021; McGuire et al., 2015; Muller et al., 2018; Reid et al., 2016), relaxation exercises (i.e., Dover et al., 2021; Dozier et al., 2015b; Muller et al., 2018; Schneider & Arch, 2017), counterconditioning (i.e., Dozier, 2015a, 2015b), acceptance and distress tolerance strategies (i.e., Cowan & Marks, 2022; Dover et al., 2021; Kamody & Del Conte, 2017; Lewin et al., 2021; Schneider & Arch, 2017; Petersen & Twohig, 2022), exposure and response prevention (i.e., Altınöz et al., 2018; Bernstein et al., 2013; Cowan & Marks, 2022; Dover et al., 2021; Lewin et al., 2021; McGuire et al., 2015; Muller et al., 2018; Reid et al., 2016), interpersonal communication

skills (i.e. Bernstein et al., 2013; Muller et al., 2018; Petersen & Twohig, 2022), attentional control skills (Bernstein et al., 2013; Lewin et al., 2021; Reid et al., 2016), and parent management training (Dover et al., 2021; Muller et al., 2018). Case studies are useful beginning points for treatment development and provide a direction for clinicians in the absence of a clear gold standard of care. However, these case studies do not provide clear or compelling evidence of efficacy for any particular intervention.

Among these treatments, three strategies were most frequently used. First, cognitive intervention was a central component of many treatment studies for misophonia. Patients with misophonia commonly report maladaptive thoughts, such as "My family makes these sounds to annoy/aggravate me", "people are imperceptive, selfish, uncaring, unaccommodating, and dismissive of my needs", and "disgust and rage are intolerable". When patients' maladaptive thoughts that contribute to high levels of stress are modified, misophonia symptoms can decrease (e.g., Bernstein et al., 2013; McGuire et al., 2015).

Secondly, behavioral interventions such as counter-conditioning were also commonly used in the treatment of misophonia. A counterconditioning approach can be used when neutral or pleasant situations or events have been linked to intrinsically negative feelings (Kerkhof et al., 2011). To initiate positive associations with misophonia triggers, an intense pleasant unconditioned stimulus, e.g. a positive image or video, would repeatedly be paired with a conditioned stimulus, such as a video clip of someone chewing. Through the process of learning to associate triggers with positive or neutral stimuli, the original association between triggers and intense negative emotions is inhibited, resulting in a decrease in misophonia symptoms.

Additionally, acceptance and distress tolerance concepts taught in ACT and DBT seemed particularly relevant given the fact that misophonia triggers can result in immediate, overwhelming feelings of anger, rage, and disgust that patients may find intolerable even

after a brief exposure to misophonia triggers. In exposure- based interventions that target acceptance of something unwanted (e. g., emotion, outcome, sensation, memory), the reduction of symptoms typically follows when one ceases to resist an unwanted experience and develops a willingness to experience it, to accept it (Cowan et al., 2022). Mindfulness and acceptance also help patients become aware of their emotions and increase their ability to tolerate distress.

Open Trials

Three open trials have been conducted to treat misophonia (Frank & McKay, 2019; Jager et al., 2021; Schröder et al., 2017; See Table 2). Schröder et al., (2017) conducted an uncontrolled trial involving 90 adults with misophonia, showing promise for a cognitive behavioral approach using brief group therapy. In this trial, 48% of participants improved on a clinician rating of outcome, and 30% reported a significant reduction in symptoms on a self-report measure of misophonia. The treatment included four main components: (1) attentional shifting away from trigger stimuli, (2) counterconditioning to disrupt classically conditioned associations between neutral/positive stimuli that have become paired with negative emotional experiences, (3) stimulus manipulation exercises (allowing the participant to manipulate trigger sounds), and (4) relaxation exercises. Because this intervention occurs in a group, validation and support from other sufferers may also be an important component of this treatment.

Frank and McKay (2019) reported that 18 participants received exposure therapy before or after stress management training. The exposure procedure used an inhibitory learning model, emphasizing altered expectations for the target sounds along with the deliberate practice of hearing sounds on an individual hierarchy. Rather than targeting habituation of psychological distress when exposed to triggers, the inhibitory learning approach to exposure enhances patient motivation to approach triggering cues and contexts

by changing the features of these cues or their responses to them in an effort to change expectations, increase psychological flexibility, enhance valued actions and increase the perception of control over reactions to misophonic cues. This study demonstrates that without habituation to certain sounds, inhibitory learning-based exposure procedures may be a promising way to enhance perceived control over emotional reactions to misophonia triggers.

Finally, Jager et al. (2021) used an open trial to evaluate the efficacy of eye movement desensitization and reprocessing (EMDR) therapy in treating misophonia in 10 participants. Misophonia-related emotionally disturbing memories were addressed with EMDR in 2.6 sessions lasting 60–90 minutes on average. Participants reported a 20% average reduction in symptoms of misophonia on a self-report measure of misophonia, suggesting a slight reduction in misophonia symptoms. Due to the uncontrolled experimental design of these open trials, no definitive conclusions can be drawn from these studies about treatment efficacy, though these are valuable studies pointing to possible treatments to further evaluate.

Randomized Clinical Trial

Jager et al. (2020b) conducted the only randomized controlled trial for misophonia (See Table 2). Using a cross-over design, adults with misophonia ($N = 54$) were randomly assigned to 3 months of weekly group-CBT or a wait list and tested at baseline, 3 months (following CBT or wait list), 6 months (after cross-over), and 15/18 months (1-year follow-up). CBT groups included task concentration, arousal reduction, positive affect labeling, and stimulus manipulation. Across all participants, symptoms of misophonia improved by 32% after 3 months. Clinical improvement was observed in 37% of the CBT group compared to 0% in the waiting list group. At 1 year follow-up, CBT had maintained its effects.

This randomized trial is the clearest evidence supporting the use of any specific treatment for misophonia. However, it should be noted that the comparison condition was an

unblinded wait list control without any active or credible components. Additional studies are needed comparing this protocol to credible control conditions featuring non-specific factors such as psychoeducation, therapist time and attention, validation, and/or support. Nonetheless, the findings of this trial and, collectively, the combined findings across the preliminary case studies and open trials largely indicate that components from CBTs (e.g., cognitive restructuring, exposure and counterconditioning, relaxation exercises, interpersonal communication and acceptance-based skills) may be reasonable for clinciains to consider and in need of future study as treatments for misophonia in both youth and adults.

Transdiagnostic Approaches to Psychotherapy

Unified Protocol. As outlined, early studies suggest misophonia (a) is not best accounted for by any psychiatric disorder, (b) is associated with various transdiagnostic psychological problems, and (c) pilot studies developing promising treatments have used various interventions from the family of CBTs. Accordingly, when considering which treatment approaches to scientifically evaluate, it may not be appropriate to use a specific branded psychotherapy protocol designed for a specific diagnosis. Instead, transdiagnostic psychotherapies are a reasonable and appropriate alternative. The Unified Protocol (UP; Barlow et al., 2014) is a reasonable candidate transdiagnostic psychotherapy to consider, as it has been developed and evaluated for use with a wide range of "emotional disorders," including anxiety and mood disorders.

The UP is 16-week skills-based treatment that consists of 5 core modules: mindful emotional awareness, cognitive flexibility, identifying and changing emotional avoidance, increasing tolerance of emotion-related physical sensations, and emotional exposures (Barlow et al., 2017). Patients with misophonia may be characterized by problems with emotional reactivity, limited access to emotion regulation strategies, and intolerance of elevated physical sensations when exposed trigger sounds (e.g., Dozier & Morrison, 2017; Guetta et

al., 2022). The core modules in the UP target these processes. The transdiagnostic approach of the UP has demonstrated efficacy against single-disorder treatments in multiple studies (Barlow et al., 2017; Steele et al., 2018). This success may be due to the high rates of co-occurrence between emotional disorders, with anxiety and depressive disorders having lifetime rates of co-occurrence as high as 75% (Steele et al., 2018). As examples of efficacy, the UP has demonstrated improvements in anxiety (Barlow et al., 2017), obsessive-compulsive disorders (Sakiris & Berle, 2019), and dysregulated anger across a range of clinical presentations (Cassiello-Robbins et al., 2020). Patients with misophonia may have high rates of co-occurring mental health problems (Jager et al., 2020; Rosenthal et al., 2022), suggesting that the UP may be a helpful approach to consider.

Although a recent case study reported that the UP is a promising treatment for adolescents with misophonia (Tonarely-Busto et al., 2022), controlled clinical trials are needed before conclusions can be made about the efficacy of the UP for misophonia. Our own research team is currently conducting preliminary open trials and developing a manual using the UP to treat adults with misophonia. Of eight participants treated with the UP, none dropped out of the treatment, and all reported that they found the treatment helpful. Patients also reported that learning about their own unhelpful coping mechanisms was important, as was enhanced skill use for emotional responses to trigger sounds (McMahon et al., 2021).

Process-Based Therapy (PBT). Although manualized models of psychotherapy such as the UP may be helpful, another candidate approach that is transdiagnostic and highly flexible is the Process-Based Therapy (PBT; Hayes & Hoffman, 2018) framework. In PBT, therapists leverage evidence-based therapeutic processes that are common across therapies (e.g., strong therapeutic alliance, empathy, support, motivational enhancement) and specific procedures used across protocols for various diagnoses and problems (e.g., the list of interventions in Table 1). PBT assessment features functional analyses to identify

maladaptive and adaptive patterns and measurement-based care using both qualitative and psychometrically validated quantitative measures of functioning and change processes. Additionally, targets for treatment are collaboratively selected in a sequence that is acceptable to patients and intended to impact other targets in a network of related change processes. This enables an emphasis on patient strengths and empowerment, with assumptions of non-linear change leading to iterative and flexible changes in targets and therapeutic procedures throughout treatment.

When using PBT for misophonia, a therapist and patient determine through functional analyses that there are problematic patterns before, during, or after being triggered across attentional (e.g., hypervigilance), cognitive (e.g., internal, stable, and global attributions), physiological (e.g., sympathetic arousal), social (e.g., verbal confrontations), or other behavioral (e.g., avoidance or escape behavior) levels of functioning. After discerning specific personally-relevant patterns, problematic patterns are collaboratively prioritized for targeted change. Next, therapeutic procedures known empirically to impact targeted patterns are offered by the therapist, and the patient chooses the one they are most willing and able to do (e.g., to reduce physiological arousal when triggered, the patient could choose any protocol known to reduce sympathetic arousal). The intervention is administered, the patient applies the intervention in their daily life, and measures are taken to determine the effects of the intervention. When progress is made on a prioritized target, the patient selects the next most prioritized target to address, and the process repeats itself until patients are satisfied that they have met treatment goals. PBT is an approach that our group is currently testing for misophonia, with a manual under development iteratively based on patient feedback. As such, it is unknown if this approach is efficacious for misophonia.

Research Agenda for Treatment Development

Mechanistic translational studies. Studies identifying underlying neurobehavioral mechanisms of misophonia are needed to develop optimal interventions that target precise biological, social, or behavioral change processes. Candidate targets include difficulties with attention (e.g., hypervigilance toward possible misophonic cues), cognition (e.g., attributional styles, hopelessness), behavior (e.g., avoidance, escape), social (e.g., indirect aggression), and emotional (e.g., sensitivity, reactivity) processes. As researchers seek to discover underlying change processes in misophonia, it will be important to do so using multi-method studies with objective laboratory-based measures. To discern processes that are germane to misophonia, and not to people with other sound intolerance or mental health conditions, mechanistic researchers will need to control for these considerations in their experimental design (e.g., control conditions) and statistical approaches (e.g., controlling for the influence of these conditions statistically).

Global research with diverse participants. To date, most studies investigating misophonia have included disproportionately White, educated women as participants. It may be that these demographic factors align with access to knowledge about misophonia or motivation to participate in research. However, some studies using sampling methodologies with more representative approaches have not reported gender differences in misophonia symptoms (Jakubovski et al., 2022). Similarly, no studies have explored ethnicity, race, or multi-cultural considerations related to misophonia. To understand the nature and features of misophonia for all people, it is essential for researchers to use sampling methods that include diverse participants.

Multi-disciplinary treatment models. Although a multi-disciplinary model of evaluations and treatment is recommended as a general strategy, there are no studies empirically testing this approach. In order to determine for whom, how, and why this model may be helpful, multi-disciplinary research is needed. This could include direct testing of

such an approach compared to usual treatment or discipline specific interventions. This also could include using adaptive designs that begin with fewer resources and, for those who are non-responsive, randomizing participants to higher resource treatment approaches.

Psychoeducation and support. It is uncommon for clinical providers or the lay public to have extensive knowledge about misophonia. This overall lack of public awareness about misophonia frequently translates into patients and loved ones needing foundational psychoeducation and support in how to make sense of and manage misophonia. Particularly for caregivers and those with somewhat less impairing misophonia presentations, it may be that psychoeducation and support can serve an important, low cost, and scalable component of an overall treatment approach. Studies are needed to examine whether, for whom, and how such approaches can be helpful.

Digital health. Another recommended approach for treatment development is the use of digital health-based models of care. This could include, for example, interventions using mobile phones with misophonia support apps to screen, educate, support, and provide specific real time interventions targeting underlying mechanistic change processes (e.g., attentional hypervigilance, emotional reactivity, indirect interpersonal aggression, approach or avoidance behavior, cognitive reframing or defusion). In addition, digital health approaches that train novel coping skills in virtual environments or with augmented reality could directly target underlying mechanistic targets of change and, in some instances, provide real time feedback and tailored interventions based on user input and machine learning. These platforms can provide immersive and engaging experiences that may be more desirable for some than conventional treatment approaches such as psychotropic medication or psychotherapy.

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Table 1 Case Studies of Misophonia Treatment

Studies	Treatment	Strategies								Age	Gender	Comorbidity	Session	Misophonia Assessment		
		cognitive restructuring	relaxation exercises	counter-conditioning	acceptance & distress tolerance	ERP	interpersonal skills	attention control	parenting training					Baseline	Post	Symptom Reduce
Bernstein 2013	CBT	√				√	√	√		19	Female	None	6	NA	NA	NA
Dozier 2015(a)	NRT			√						48	Female	NA	14	MAQ41	MAQ9	MAQ78%
Dozier 2015(b)	NRT		√	√						21	Female	None	4	MAQ49	MAQ13	MAQ73%
McGuire 2015	CBT	√				√				17	Female	None	10	MQ55 MSS12	MQ37 MSS7	MQ33% MSS42%
										11	Female	None	18	MQ31 MSS5	MQ25 MSS4	MQ19% MSS20%
Reid 2016	CBT	√				√		√		14	Female	OCD,MDD,phobia,ADHD	14	AMISOS17	AMISOS7	AMISOS59%
Kamody 2017	DBT				√					16	Female	social anxiety	7I+35G	AMISO22 MAQ51	AMISO10 MAQ16	AMISO 55% MAQ 71%
Schneider 2017	DBT& ACT		√		√					17	Male	None	10	AMISOS14	AMISOS8	AMISOS57%
Altýnöz 2018	CBT	√				√				18	Female	NA	6	MAS6 MPRS6 AMISOS11	MAS2 MPRS2 AMISOS4	MAS67% MPRS67% AMISOS64%
Muller 2018	CBT	√	√			√	√		√	14	Female	None	24	NA	NA	NA
Dover 2021	CBT	√	√		√	√			√	10	Female	OCSD	30	AMISOS10 MQ27	AMISOS3 MQ6	AMISO70% MQ78%
Lewin 2021	UP	√			√	√		√		4 cases, NA			10	MAQ25 AMISOS13 MAQ18 AMISOS15 MAQ12 AMISOS9 MAQ54 AMISOS17	MAQ13 AMISOS9 MAQ25 AMISOS12 MAQ3 AMISOS6 MAQ13 AMISOS10	MAQ48% AMISOS31% MAQ+39% AMISOS20% MAQ75% AMISOS33% MAQ76% AMISOS42%
Cowan 2022	EASE[1]				√	√				14	Female	NA	6	NA	NA	NA
Petersen 2022	ACT				√		√			12	Female	NA	16	AMISOS10	AMISOS5	AMISOS50%

Abbreviation: ACT, Acceptance and Commitment Therapy; ADHD, Attention Deficit Hyperactivity Disorder; AMISO, Amsterdam Misophonia Scale; CBT, Cognitive Behavioral Therapy; DBT, Dialectic Behavioral Therapy; EASE, Experiential Acceptance and Stimulus Engagement; ERP, Exposure and Reaction Prevention; MAQ, Misophonia Assessment Questionnaire; MAS,

Misophonia Activation Scale; MPRS, Misophonia Psychological Response Scale; MQ, Misophonia Questionnaire; MSS, Misophonia Severity Scale; NA, Not Applicable; NRT, Neural Repatterning Technique; OCD, Obsessive-Compulsive Disorder; OCSD, Obsessive-Compulsive Spectrum Disorder; 7I+35G, 7 Individual Sessions and 35 Group Sessions

Table 2 Open Trials and Randomized Clinical Trial of Misophonia Treatment

Studies	Treatment	cognitive restructuring	relaxation exercises	counter-conditioning	attention control	ERP	stimulus manipulation	Others	Participants	Age	Comorbidity	Session	Symptom Reduce
Open Trials													
Schr¨oder 2017	Group-CBT		√	√	√		√		90	36	NA	8	AMISOS-R 33%
Frank 2019	Inhibitory Learning	√				√			18	35	56%	12	NA
Jager 2021	EMDR							desensitization & reprocessing	10	35	50% Axis I, 60% Axis II	2.6	AMISOS-R 20%
Randomized Clinical Trial													
Jager 2020	Group-CBT	√	√	√	√		√	psycho-education for family&friends	27	31	NA	12	AMISOS-R 32%

Abbreviation: CBT, Cognitive Behavioral Therapy; EMDR, Eye Movement Desensitization and Reprocessing; NA, Not Applicable; AMISOS-R, Amsterdam Misophonia Scale-Revised