Sound Sensitivity Management

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Conflicts of Interest

- I work at Univ Miss Med Center/Ole Miss
- Editorial Advisor of Audiology Today
- No affiliation with a specific manufacturer
- Receive a small honorarium for this lecture
On the Agenda

- Type of Sound Sensitivity
- Overview of Popular Management Approaches
- Introduction to Holistic Five Step Approach
  - Integrate discussion of counseling, sound therapy options, adjunct therapy, and lifestyle
Types of Sound Sensitivity
Sound Sensitivity

- Normal Loudness Perception
- Abnormal Loudness Perception
  - Misophonia
  - Hyperacusis
    - Phonophobia
    - Recruitment
      - Sensory Processing Disorder
      - Pain
      - Dizziness, autophony
First: Types of Tinnitus

- Hyperacusis
  - Abnormal reaction to moderate level sounds
- Phonophobia
  - Patient fears sounds
- Misophonia (Jastreboff)
  - Sensitivity to specific sounds
  - Selective sound sensitivity syndrome (4S, Johnson)
- Loudness Recruitment
  - Sensitivity to louder sounds and associated with hearing loss
- Diplacusis or polyacusus
  - Distorted perception of sounds, resulting in perception of multiple sounds or noise with a single pure tone
  - Usually associated with hearing loss, rarely reported as an issues except among musicians
Sound Sensitivity Theory

Peripheral
- Hair Cell
- Auditory Nerve
  - Spontaneous Rate
  - Change in neural afferent potentiation
- Other neural
  - Imbalance of afferent and efferent input
  - Facial nerve dysfunction

Central
- Hyperactivity/increased spontaneous activity
- Loss of inhibition
- Central Gain
- Reorganization of mapping
- Multisensory input
- Limbic System & Non-Auditory Regions
- Dysfunctional Gating
SS Theory

- **Loudness recruitment**
  - Abnormal growth of loudness
  - Damage affecting non-linearity
  - Sensitivity usually to louder abrupt onset sounds (e.g. dishes clattering)
SS Theory

- **Hyperacausis**
  - Prevalence estimates between 3.2 to 17.6%
  - Commonly comorbid to tinnitus
  - Central gain, efferent changes, phantom percepts, afferent neural damage (Jasterboff 2000, Hickox & Liberman 2013)
    - Can experience pain: type II afferents (Pain Hyperacusis)
  - Great review by Auerbach et al. 2014
Central gain control in tinnitus and hyperacusis

Benjamin D. Auerbach†, Paulo V. Rodrigues† and Richard J. Salvi*
Lendavi et al. 2011

Lin et al., 2011
Correlates with neural pain suggested to be related to auditory nociception and changes associated with loss of type 2 afferent terminals (Liu et al 2015)
SS Theory

• Changes in central auditory and non-auditory regions (Auerbach et al. 2014)
  – Type II fiber activation
  – Hyperactivity in brainstem, auditory cortex, and amygdala
  – Trigeminal nociceptive
Amygdala hyperactivity and tonotopic shift after salicylate exposure
Original Research Article
Pages 63-76
Guang-Di Chen, Senthilvelan Manohar, Richard Salvi
Amygdala - outputs

"Upstream"

nociceptive amygdala (CeLC)

hypothalamus

autonomic endocrine

"Downstream"

pain behavior

brainstem (PAG → RVM)

spinal cord

cognition
(attention, decision-making)

cortex

SS Theory

- Phonophobia (ligyrophobia or fear hyperacusis)
  - Abnormally strong reactions of autonomic and limbic systems, commonly aggravated form of hyperacusis (Jasterboff 2000)
  - Fear of sound can manifest with or without sound loudness intolerance
  - Extreme version of hyperacusis or misophonia
Amygdala - fear

Evidence from anatomical, pharmacological, electrophysiological, and behavioral studies

Medina, Repa, Mauk, LeDoux 2002

LA, lateral amygdala; CE, central amygdala; CG, "central gray" = periaqueductal gray (PAG); LH, lateral hypothalamus; PVN, paraventricular nucleus of hypothalamus
SS Theory

- Misophonia (annoyance hyperacusis)
  - Conditioned response?
  - Symptom of other psychological disorder (anxiety, OCD, Tourettes, etc), neurological disorder, psychosomatic feature?
  - Hormonal?
  - External Tinnitus?
Functional auditory disorders.

Baguley DM, Cope TE, McFerran DJ.
PMID: 27719856

Misophonia is a neglected disorder.

Blygved-Nissen G, Thomsen PH.
PMID: 26617171

Mastication rage: a review of misophonia - an under-recognised symptom of psychiatric relevance?

Bruunner G.
PMID: 28308801

Misophonia and contemporary psychiatry.

Gédance D.
PMID: 26449104

Misophonia: current perspectives.

Cavanna AE, Seri S.
PMID: 26318758

Cognitive-behavioral therapy for 2 youths with misophonia.

McGuire JF, Wu MS, Storch EA.
PMID: 26035184
Why So Sensitive?

- Commonalities to these **aversive** sounds
  - Repetitive
  - Jarring (unpleasant vibration)
  - Associated with being rude or of poor etiquette
  - Associated with sign of danger?
  - Associated with certain source?
  - Pitch quality
Why So Sensitive?

- Frequency Spectrum and Psycho-acoustics
  - High Frequency Components
    - Auditory irritants and impalpable pain, Boyd 1959
    - Aversiveness without pain: Potentiation of imaginal and auditory effects of blackboard screeches, Ely 1975
Why So Sensitive?

- Frequency Spectrum and Psycho-acoustics
  - Not High Frequency
    - *Psychoacoustics of chilling sound*, Halpren et al. (1986).
      - Middle frequency regions the culprit, related to warning vocalizations
      - Ig Nobel Prize

<table>
<thead>
<tr>
<th>Table 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>List of 16 Sounds Used in Experiment 1, and the Average Rating (Expressed as Position in Centimeters Along the Line) and Standard Error Assigned to Each</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sound</th>
<th>Average Rating (cm)</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chimes</td>
<td>4.72</td>
<td>0.57</td>
</tr>
<tr>
<td>2. Rotating bicycle tire</td>
<td>5.49</td>
<td>0.50</td>
</tr>
<tr>
<td>3. Running water</td>
<td>5.89</td>
<td>0.55</td>
</tr>
<tr>
<td>4. Jingling keys</td>
<td>6.25</td>
<td>0.67</td>
</tr>
<tr>
<td>5. Pure tone</td>
<td>8.79</td>
<td>0.62</td>
</tr>
<tr>
<td>6. Pencil sharpener</td>
<td>8.81</td>
<td>0.54</td>
</tr>
<tr>
<td>7. Shaking metal parts</td>
<td>8.89</td>
<td>0.53</td>
</tr>
<tr>
<td>8. White noise</td>
<td>9.09</td>
<td>0.57</td>
</tr>
<tr>
<td>9. Compressed air</td>
<td>9.58</td>
<td>0.58</td>
</tr>
<tr>
<td>10. Blender motor</td>
<td>10.90</td>
<td>0.46</td>
</tr>
<tr>
<td>11. Dragged stool</td>
<td>11.43</td>
<td>0.43</td>
</tr>
<tr>
<td>12. Metal drawer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>being opened</td>
<td>12.12</td>
<td>0.43</td>
</tr>
<tr>
<td>13. Scraping wood</td>
<td>13.03</td>
<td>0.38</td>
</tr>
<tr>
<td>14. Scraping metal</td>
<td>13.08</td>
<td>0.39</td>
</tr>
<tr>
<td>15. Rubbing two pieces</td>
<td>13.39</td>
<td>0.38</td>
</tr>
<tr>
<td>of styrofoam together</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Scraping slate</td>
<td>13.74</td>
<td>0.18</td>
</tr>
</tbody>
</table>

*Note – The descriptor "scraping" refers to dragging the three-pronged garden tool across the designated surface.*
Why So Sensitive?

- Frequency Spectrum and Psycho-acoustics
  - Not just the sound
    - *Psychoacoustics of chalkboard squeaking*, Reuter and Oehler, 2011
      - Replicated Halpren et al (1986), but also used electrophysiological measures
      - In addition examined knowledge of source: telling some music and others chalkboard
      - Removing 2000-4000 Hz frequency range decreased unpleasantness.
      - Prior knowledge greatly impacted subjective response, but skin conductivity still changed
    - *Mapping unpleasantness of sounds to their auditory representation*, Kumar et al., 2008
      - Modulation in temporal waveform below 16 Hz
Misophonia

• Is misophonia an independent disorder, symptom, subcategory/variant of existing disorder ??????
  – Auditory vs. Non-auditory issue
    ▪ Auditory gain issue? Not likely
    ▪ Auditory-limbic issue? Possibly
  – Physiological vs Psychological vs Psycho-physiological
    ▪ Is misophonia a conditioned response?
    ▪ Is misophonia a sub-category of psychological disorder
    ▪ Is there a genetic component?
    ▪ Is misophonia a neurophysiological distortion (e.g. synesthesia)?
    ▪ Auditory vs. Non-auditory triggers
Misophonia

- Dislike of specific sounds: hypersensitivity to sounds generally ignored by others.
- Decreased Sound Tolerance
Table 1 | Summary of qualitative data gathered from interviews of the 11 misophonic subjects (4 males and 7 females, mean age = 35.82; range = 19–65) in Experiment 1, broken down into 18 of the most salient diagnostic categories.

| Age of onset | 8–10 years old (3)–27%  
|              | As long as can remember (3)–27%  
|              | Childhood (3)–27%  
|              | 17 (1)–9%  
|              | Early teenage years (1)–9%  
| Worst trigger sounds | Eating/chewing/crunching sounds (11)  
|                      | Lip smacking (2)  
|                      | Pen clicking (2)  
|                      | Clock ticking (2)  
| Other trigger sounds | Low frequency bass sounds (8)  
|                      | Pen clicking (4)  
|                      | Footsteps (3)  
|                      | Finger tapping (3)  
|                      | Whistling sounds (3)  
|                      | Typing (3)  
|                      | Lip smacking (2)  
|                      | Clock ticking (1)  
|                      | Plastic bags (1)  
|                      | Repetitive barking (1)  
|                      | Finger tapping (1)  
|                      | Sniffling (1)  
| Localized around certain individuals? | Yes (9)–82%  
|                                  | No (2)–18%  
| Worsened over time? | Yes (5)–45%  
|                             | Stays the same (3)–27%  
|                            | No, gotten better (2)–18%  
|                           | N/A (1)–9%  
| Own trigger sounds ok? | Yes (10)–91%  
|                       | Avoids producing own trigger sounds (1)–9%  
| Repetitive sounds worse | Yes (9)–82%  
|                         | N/A (2)–18%  

| Physical locations and descriptions of discomfort (*A) | Pressure in chest, arms, head, or whole body (5)  
|                                                       | Clenched/tightened/tense muscles (5)  
|                                                       | Increase in body temperature, blood pressure, or heart rate (2)  
|                                                       | Pained by trigger sounds (1)  
|                                                       | Hard to breathe (1)  
|                                                       | Sweaty palms (1)  
| Visual triggers | Jiggling/swinging legs (5)  
| Bothered by Ss sounds | Yes (6)–55%  
|                     | N/A (3)–27%  
|                     | No (2)–18%  

| Feelings and emotions associated with trigger sounds* | Sounds are invasive, intrusive, insulting, violating, offensive, disgusting, rude (9) (*A,D)  
|                                                      | Stress/anxiety (5)  
|                                                      | Anger or rage (4) (*D)  
|                                                      | Extreme annoyance/irritation (4) (*A,D)  
|                                                      | Panic (2) (*B)  
|                                                      | Impatience (1)  
|                                                      | Aggravation (1) (*D)  
|                                                      | Feeling trapped (1) (*B)  

| Other potentially comorbid medical conditions (*F) | Tinnitus (2)  
|                                                | Obsessive-compulsive personality traits (2)  
|                                               | Hyperacusis (1)  
|                                              | Auditory processing disorder (1)  
|                                             | ADD (1)  
|                                            | PTSD (1)  
|                                          | None (6)  

| Coping strategies | Avoiding or removing self from certain situations (7) (*D,E)  
|                   | Mimicry to “cancel out” sound or retaliate (6)  
|                   | Earplugs/headsets/music (6)  
|                   | Is conscientious about own sounds (5)  
|                   | Distract self (5)  
|                   | Ask others to stop (4)  
|                   | Positive internal dialog (1)  

Edelstein et al., 2013
Edelstein et al., 2013

**Aversiveness Ratings by Group**

![Aversiveness Ratings by Group](image)

**Average Evoked Skin Conductance Response**

![Average Evoked Skin Conductance Response](image)

*FIGURE 1* Average misophonic and control participants' skin conductance response to auditory and visual stimuli as a function of time.
P1 (50 ms) associated with pre-attention orienting toward new sound (i.e. sensory gating)

N1 (100 ms) related to early attention and focus on abrupt changes and new sounds (commonly attenuated in persons with schizophrenia, cocaine use and bipolar disorders)

P2 (200ms) associated with initial conscious awareness

Schroder et al. (2014) found no difference in response for the standard tone

Significant group difference for N1 with deviants
  - Hyperarousal/general irritability
  - Medications
  - Group difference only does not mean clinically sig.
  - OCPD

Table 2: Group averages of mean amplitudes (in microvolt) and peak latencies (in milliseconds) for the different tones (standard, low deviant, high deviant) and components (P1, N1, and P2).

<table>
<thead>
<tr>
<th>Component</th>
<th>Control</th>
<th>Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Amplitude</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>0.201</td>
<td>0.465</td>
</tr>
<tr>
<td>Low deviant</td>
<td>0.324</td>
<td>0.337</td>
</tr>
<tr>
<td>High deviant</td>
<td>-0.080</td>
<td>0.219</td>
</tr>
<tr>
<td>Peak Latency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>77</td>
<td>84</td>
</tr>
<tr>
<td>Low deviant</td>
<td>68</td>
<td>73</td>
</tr>
<tr>
<td>High deviant</td>
<td>65</td>
<td>75</td>
</tr>
</tbody>
</table>
Trigger Sounds

- Mouth and Eating
- Breathing/Nasal
- Vocalizations
- Body Movement
- Environmental
- Even Anticipation of these sounds
Breakdown of Popular Approaches
What approach for sound sensitivity management do you currently use?

A. Tinnitus retraining therapy for sound sensitivity
B. Tinnitus activities treatment for sound sensitivity
C. Modified version (my own thing)
D. Don’t provide any formal counseling, just basic education and sound generators
E. Don’t see sound sensitivity patients
Approaches Overview

- Numerous approaches to sound sensitivity have been developed over the past few decades and are commonly comparable approaches used for tinnitus with slight variations in counseling and sound therapy recommendations
  - Sound therapies (Many variations with and without counseling)
  - Cognitive Behavioral Therapy influenced Counseling (Many contributors)
    - Tinnitus Activities Treatment (Tyler and colleagues)
    - Integrated Approach to Tinnitus Patient Management (Sweetow and colleagues)
  - Tinnitus Retraining Therapy (Jastreboff and colleagues)
  - Progressive Tinnitus Management (Henry and colleagues)
  - Patient Centered Therapy (Acceptance of tinnitus as part of me (Mohr and colleagues)
  - Acceptance and Commitment Therapy (Hesser, Westin, and others)
  - Mindfulness based tinnitus stress reduction (Gans)
  - Combination of the above or modified approaches (Many others)
Approaches Overview

- Though there are philosophical difference in these approaches, they also have a great deal in common.
  - Counseling of some type: Common
  - Sound therapy of some type: Common
  - Seek to desensitize system
  - Some potential differences are the areas emphasized in counseling, perspectives of directive vs collaborative interaction with patient, idea of classical conditioning vs. operant conditioning, and level setting and type of sound for sound therapy
Approaches Overview

- Classical conditioning vs. Operant conditioning
Approaches Overview

- CBT based approaches use more of a cognitive perspective and the restructuring of cognition via conscious strategy for voluntary change.

- Classical conditioning based approaches emphasize the subconscious processing to alter the conditioned reflex.
Approaches Overview

- **Cognitive-behavioral therapy**
  - Combination of the principles of behavioral and cognitive principles; to alter one’s thoughts about their problem and identify behaviors that contribute to problem and subsequent reaction
  - Patients can then address these distorted conceptions to overcome the problem once they recognize them (e.g. cognitive distortions like all or none thinking, generalization, disqualifying positive).
  - Numerous randomized control trials have shown success with affective elements of tinnitus (Cima et al. 2014).
Thoughts create feelings

Behavior reinforces thoughts

Feelings create behavior
Cognitive-behavioral therapy and sound sensitivity

- CBT (Psychotherapy)
  - Consists of face to face sessions, anywhere from 6-18, for around an hour each, over many weeks, occasional “booster” sessions are provided
  - Performed by a licensed therapist/psychologist in CBT
  - Good idea to find someone in your area as a referral source, if no one in your area there are telehealth alternatives
# Approaches Overview

Overview of the treatment program.

<table>
<thead>
<tr>
<th>Session</th>
<th>Psychoeducation</th>
<th>Work in sessions</th>
<th>Homework assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1</td>
<td>CBT model for treatmentApplied relaxation</td>
<td>Treatment planningGoal settingApplied relaxation 1</td>
<td>Psychoeducative materialApplied relaxation</td>
</tr>
<tr>
<td>Session 2</td>
<td>CBT model for treatmentApplied relaxation</td>
<td>Applied relaxation 2Exposure therapy</td>
<td>Psychoeducative materialApplied relaxationSound enrichmentExposure therapy</td>
</tr>
<tr>
<td>Session 3</td>
<td>Risk assessment regarding soundApplied relaxation</td>
<td>Applied relaxation 3Exposure therapy</td>
<td>Psychoeducative materialApplied relaxationSound enrichmentExposure therapy</td>
</tr>
<tr>
<td>Session 4</td>
<td>Applied relaxation</td>
<td>Applied relaxation 4Exposure therapy</td>
<td>Psychoeducative materialApplied relaxationSound enrichmentExposure therapy</td>
</tr>
<tr>
<td>Session 5</td>
<td>Behavioural Activation</td>
<td>Applied relaxation 5Exposure therapy</td>
<td>Applied relaxationExposure therapySound enrichmentBehavioural Activation</td>
</tr>
<tr>
<td>Session 6</td>
<td>Behavioural Activation Relapse prevention</td>
<td>Exposure therapyGoal evaluationRelapse prevention</td>
<td>Applied relaxationExposure therapySound enrichmentBehavioural Activation</td>
</tr>
</tbody>
</table>

Juris et al. 2014
Cognitive-behavioral therapy and sound sensitivity

CBT-based approaches (Adjustment Counseling)-Audiologist provided

- CBT-based approaches (Adjustment Counseling)—consists of application of CBT principles often with sound-based therapy and other techniques like relaxation training, imagery, and etc.

- Robert Sweetow, PhD: “patient may reject a purely psychological approach, instead patient should be counseled on physiological origin, but the reaction is ultimately a psychological interpretation”
TAKE A VACATION
FROM YOUR PROBLEMS
Approaches Overview

○ **Tinnitus Retraining Therapy**
  ○ Developed by Jastreboff and Hazell over 25 years ago
  ○ Based on the Neurophysiological Model of Tinnitus
    ○ Auditory system is secondary, primary are non-auditory regions (in particular limbic system)
  ○ Primarily uses directive/educational counseling
  ○ Primary goal is habituation of reaction and/or perception of tinnitus
  ○ In the case of sound sensitivity or decreased sound tolerance, desensitization is used
  ○ Patients can be categorized based on perception of tinnitus, perceived hearing loss, and sound sensitivity
  ○ Sound therapy component suggest a “mixing point”
Fig. 1: Block diagram of the neurophysiological model of tinnitus.
### Table 1  Categories of Tinnitus and Hyperacusis Patients

<table>
<thead>
<tr>
<th>Category</th>
<th>Hyperacusis</th>
<th>Prolonged Sound-Induced Exacerbation</th>
<th>Subjective Hearing Loss</th>
<th>Impact on Life</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Low</td>
<td>Counseling only</td>
</tr>
<tr>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>High</td>
<td>Sound generators set at mixing point</td>
</tr>
<tr>
<td>2</td>
<td>—</td>
<td>—</td>
<td>Present</td>
<td>High</td>
<td>Hearing aid with stress on enrichment of the auditory background</td>
</tr>
<tr>
<td>3</td>
<td>Present</td>
<td>—</td>
<td>Not relevant</td>
<td>High</td>
<td>Sound generators set above threshold of hearing</td>
</tr>
<tr>
<td>4</td>
<td>Present</td>
<td>Present</td>
<td>Not relevant</td>
<td>High</td>
<td>Sound generators set at the threshold; very slow increase of sound level</td>
</tr>
</tbody>
</table>

Hyperacusis: significant sensitivity to environmental sounds typically associated with LDLs below 100 dB HL; prolonged sound-induced exacerbation of tinnitus/hyperacusis when the effects persist to the following day; subjective hearing loss: perceived subjectively by a patient as having a significant impact on patient’s life; impact on life: the extent of impact of tinnitus and/or hyperacusis on patient’s life; common treatment for each category involves counseling and the use of enriched auditory background.
Desensitization depends on issue:

- **Hyperacusis**: if with tinnitus, treat hyperacusis first
  - Taper off HPD
  - Avoid silence
  - Continual exposure to comfortable broadband sound at 9-16 dB SL
  - Sound not annoying, but relaxing but not require active listening

- **Misophonia**: requires extinction of conditioned reflex:
  Four protocols to create + association with sound
  - Taper off HPD
  - 1: Pleasant sound full control by patient, can have active listening
  - 2: Patient chooses sound but partial control of level by someone close
  - 3: Patient chooses sound but complete control by someone close
  - 4: Patient chooses sound with simultaneous exposure to aversive (Trigger) sound
    - Examples
Approaches Overview

- **Hyperacusis Activities Treatment**
  - Developed by Tyler and Colleagues and is based in principles of CBT
  - Has own classification of sound sensitivity
    - Loudness Hyperacusis
    - Annoyance Hyperacusis
    - Fear Hyperacusis
    - Pain Hyperacusis
  - Interactive counseling with sessions covering topics
    - Thoughts and Emotions
    - Sleep
    - Hearing and Communication
    - Concentration
  - Picture-based materials are used to reinforce the concepts
  - Attention on issues patient is having, discussing strategies to specific issues, and involves use of diaries and homework (activities)
  - [https://www.medicine.uiowa.edu/oto/research/tinnitus-and-hyperacusis](https://www.medicine.uiowa.edu/oto/research/tinnitus-and-hyperacusis)
Approaches Overview

Hyperacusis Activities Treatment

- Sound therapy component involves continuous use of low-level broadband noise with successive approximations to higher levels or successive approximations to trigger sounds
- Partial masking with pleasant sounds
- Taper off HPD or use of electronic noise reduction
- Greater emphasis on cognitive-behavioral elements
Our Thoughts and Emotions

Doorbell → Neutral

Doorbell → Fire

Doorbell → Injury

Doorbell → Angry neighbor

Doorbell → Flowers

Doorbell → Friend

Doorbell → Prize

Fire → Anxiety

Injury → Anxiety

Angry neighbor → Anxiety

Flowers → Happiness

Friend → Happiness

Prize → Happiness
Question
????????????
All approaches can be successful, limited data to support superiority of one over the other. Henry et al. (2016) found no difference in effectiveness of tinnitus therapies (masking, TRT, basic education with hearing aids) when performed by clinicians with limited training. When performed by a seasoned clinician significant differences were found (Henry et al. 2014). The difference is YOU!“ I KNOW WORDS. I HAVE THE BEST WORDS.” When performed by a seasoned clinician significant differences were found (Henry et al. 2014). The difference is YOU!
Differential Diagnosis
Step by Step

- Medical Evaluation
- History and Structured Interview to direct assessment and counseling
- Inventories to direct counseling
- Go over Game Plan!
- Assessment (audio, tinnitus eval, and etc)
- 5 Point Holistic Approach
  - Holistic meaning comprehensive whole person not pseudoscience
Differential

- History
  - Hearing, Medical, Social, Psychological

- EVALUATION
  - Otoacoustic emissions
    - Suppression?
  - Loudness discomfort levels (Henry et al., 2005)
    - Normal greater than 90 dB HL
    - Decrease 70-90 dB HL
    - Hyperacusis < 70 dB HL
    - All over for misophonia and phonophobia
Measurement of LDLs

- Pure tones/narrow band noises
- Continuous/pulsed
- Start in hearing thresholds and increase intensity in 5 db (or 1 db) from 250 to 8000 hz
- Perform it TWICE and consider only the second measurement
- It can be found differences of 10-15dB between both
  
  Jastreboff 04

Patient has to have the possibility to stop the test in any moment

loudness discomfort level

Normal values: OVER 90 – 100 dB according to different authors

Classification

<table>
<thead>
<tr>
<th>Degree</th>
<th>LDL</th>
<th>Dynamic range</th>
</tr>
</thead>
<tbody>
<tr>
<td>No hyperacusis</td>
<td>≥95 dB in all the frequencies</td>
<td>60db or higher</td>
</tr>
<tr>
<td>Mild HA.</td>
<td>80-90 in 2 or more freq.</td>
<td>50-55 in 1 freq</td>
</tr>
<tr>
<td>Moderated HA.</td>
<td>65-75 in 2 or more freq.</td>
<td>40-45 in 1 freq</td>
</tr>
<tr>
<td>Severe HA.</td>
<td>≤60 in 2 or more freq.</td>
<td>35 or lower</td>
</tr>
</tbody>
</table>
Differential

- Causes (reviewed by Baguley, 2003)

| Cochlear disorders | Ménière D / EH  
| Perilymphatic fistula  
| Sudden deafness I / C  
| Acoustic trauma  
| Otosclerosis
| After a surgical procedure | Post stapedectomy  
| TTTs placement  
| After wax removal
| Stapedial R. alterations (HyperAc criteria?) | Ramsay Hunt Sydr.  
| Bell’s facial palsy
| Muscular disorders | Miastenia gravis

- Ask About Fluttering Sensation or change in Pressure (tensor tympani syndrome)

- Sound Sensitivity Questionnaires
  - MASH (Dauman et al., 2005)
  - HQ (Khalfa et al., 2002)
  - Misophonia Scales
**MISOPHONIA ASSESSMENT QUESTIONNAIRE: MAQ**

Twenty One Questions

If you are a parent or caregiver, please answer for the child as best you are able, or substitute the words, “I feel that my child’s sound issues” for the words “my sound issues”.

<table>
<thead>
<tr>
<th>RATING SCALE:</th>
<th>0 = not at all, 1 = a little of the time, 2 = a good deal of the time, 3 = almost all the time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. My sound issues make me unhappy</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>2. My sound issues create problems for me.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>3. My sound issues have made me feel angry.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>4. I feel that no one understands my problems with certain sounds.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>5. My sound issues do not seem to have a known cause.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>6. My sound issues make me feel helpless.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>7. My sound issues interfere with my social life.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>8. My sound issues make me feel isolated.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>9. My sound issues create problems for me in groups.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>10. My sound issues negatively affect my work life.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>11. My sound issues make me feel frustrated.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>12. My sound issues impact my entire life negatively.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>13. My sound issues make me feel guilty.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>14. My sound issues have been classified as ‘crazy’.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>15. I feel that no one can help me with my sound issues.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>16. My sound issues make me feel hopeless.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>17. I feel that my sound issues will only get worse with time.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>18. My sound issues impact my family relationships.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>19. My sound issues have affected my ability to be with other people.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>20. My sound issues have not been recognized as legitimate.</td>
<td>0  1  2  3</td>
</tr>
<tr>
<td>21. I am worried that my whole life will be affected by sound issues.</td>
<td>0  1  2  3</td>
</tr>
</tbody>
</table>
CURRENT SEVERITY OF MISOPHONIA SYMPTOMS

This rating scale is designed to rate the severity and type of symptoms in patients with misophonia. In general, the items depend on the patient's report; however, the final rating is based on the clinical judgment of the interviewer. Rate the characteristics of each item during the prior week up until and including the item of the interview. Scores should reflect the average (mean) occurrence of each item for the entire week.

List of misophonic sounds, that trigger the most irritation, anger or disgust:
- 
- 

1. How much of your time is occupied by misophonic sounds? (How frequently do the thoughts about the misophonic sounds occur?)

<table>
<thead>
<tr>
<th>None</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild, less than 1 hr/day, or occasional (thoughts about) sounds (no more than 5 times a day).</td>
<td>1</td>
</tr>
<tr>
<td>Moderate, 1 to 3 hrs/day, or frequent (thoughts about) sounds (more than 6 times a day, most of the hours are unstimulated)</td>
<td>2</td>
</tr>
<tr>
<td>Severe, greater than 3 hrs and up to 8 hrs/day or very frequent (thoughts about) sounds.</td>
<td>3</td>
</tr>
<tr>
<td>Extreme, greater than 8 hrs/day or near constant (thoughts about) sounds.</td>
<td>4</td>
</tr>
</tbody>
</table>

2. How much do these misophonic sounds interfere with your social or work (or role) functioning? (Is there anything that you can't do because of them? If currently not working determine how much performance would be affected if patient were employed.)

<table>
<thead>
<tr>
<th>None</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild, slight interference with social or occupational activities, but overall performance not impaired.</td>
<td>1</td>
</tr>
<tr>
<td>Moderate, definite interference with social or occupational performance, but still manageable.</td>
<td>2</td>
</tr>
<tr>
<td>Severe, causes substantial impairment in social or occupational performance.</td>
<td>3</td>
</tr>
<tr>
<td>Extreme, incapacitating</td>
<td>4</td>
</tr>
</tbody>
</table>

3. How much distress do the misophonic sounds cause you? (In most cases, distress is equated with irritation, anger or disgust. Only rate the emotion that seems triggered by misophonic sounds, not generalized irritation or irritation associated with other conditions.)

<table>
<thead>
<tr>
<th>None</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild, occasional irritation/distress, not too disturbing.</td>
<td>1</td>
</tr>
<tr>
<td>Moderate, disturbing irritation/distress, but still manageable.</td>
<td>2</td>
</tr>
<tr>
<td>Severe, very disturbing irritation/distress</td>
<td>3</td>
</tr>
<tr>
<td>Extreme, near constant and disabling, anger/disgust.</td>
<td>4</td>
</tr>
</tbody>
</table>
Differential diagnosis or secondary conditions

- **Hyperacusis**: sensitivity to sound, all sounds are louder
- **Phonophobia**: fear of sound
- **Misophonia**: dislike of specific sounds not necessarily loudness issues
- **Recruitment**: abnormal growth of loudness usually sensitive to loud sounds
- **Psychological disorders** (Depression, Anxiety, Obsessive-compulsive, intermittent explosive disorder, PTSD (or acoustic shock), and etc.): many hyperacusis patients have history of anxiety
- **Sensory processing disorder**: Usually abrupt or loud sounds
- **Autism Spectrum Disorder, Williams Syndrome**: usually abrupt or loud sounds
Differential

- Differential diagnosis or secondary conditions
  - TBI
  - Bell’s palsy: facial nerve
  - Ramsay Hunt: facial nerve
  - Superior Canal Dehiscence
    - Autophony, improved BC, air-bone gap with normal tymps
  - Perilymph fistula
  - Lyme disease
  - Tensor tympani: anxiety
    - Fluttering sensation
    - Can be visualized otoscopy
  - Migraine
Proposed Dx Criteria for Misophonia

A. The presence or anticipation of a specific sound, produced by a human being (e.g., eating sounds, breathing sounds), provokes an impulsive aversive physical reaction which starts with irritation or disgust that instantaneously becomes anger.

B. This anger initiates a profound sense of loss of self-control with rare but potentially aggressive outbursts.

C. The person recognizes that the anger or disgust is excessive, unreasonable, or out of proportion to the circumstances or the provoking stressor.

D. The individual tends to avoid the misophonic situation, or if he/she does not avoid it, endures encounters with the misophonic sound situation with intense discomfort, anger or disgust.

E. The individual’s anger, disgust or avoidance causes significant distress (i.e., it bothers the person that he or she has the anger or disgust) or significant interference in the person’s day-to-day life. For example, the anger or disgust may make it difficult for the person to perform important tasks at work, meet new friends, attend classes, or interact with others.

F. The person’s anger, disgust, and avoidance are not better explained by another disorder, such as obsessive-compulsive disorder (e.g., disgust in someone with an obsession about contamination) or post-traumatic stress disorder (e.g., avoidance of stimuli associated with a trauma related to threatened death, serious injury or threat to the physical integrity of self or others).

doi:10.1371/journal.pone.0054706.t002

Schroder et al., 2013
Misophonia “Classic” Patient

- **Onset:** Childhood
- **Triggers:** Chewing and mouth related sounds, commonly starting with a specific person
  - Self-produced sounds do not trigger
  - Do not usually report sound is too loud, aka hyperacusis or phonophobia, but can
  - Not usually inanimate objects, but can be
- **Response:** Irritation, disgust, anger, and physical effects (tightening of muscles)
- **Coping:** avoidance and mimicry
Management
SS Approach

- Depends on type of SS
- TRT approach and ACT approach
  - TRT: Counseling, sound therapy (stay at one level, 9-16 dB SL) and 4 protocols for misophonia
  - Picture based counseling, sound therapy (increase level) or increase exposure to trigger
    - Record specific sounds that are too loud and play at low level in peaceful environment
    - Gradually work into realistic situations
    - Distinguish loudness of sounds and your reactions to loud sounds
    - Diary
5 Point Holistic Approach
5 Point (Holistic) Approach: Step by Step

1. Source: Counsel
2. Desensitization/Habituation & CBT: Counsel
3. Sound Therapy: Treatment
4. Distraction: Treatment
5. Diet, Lifestyle, Sleep, Cure?: Treatment
**Holistic**: Characterized by the treatment of the whole person, taking into account mental and social factors, rather than just the physical symptoms of a disease.
“patient may reject a purely psychological approach, instead patient should be counseled on physiological origin, but the reaction is ultimately a psychological interpretation” Sweetow
Counseling: How to Introduce Source Theory

○ Do your homework: read!
○ What to discuss with patient?
  ○ Normal Auditory System
  ○ Hearing Loss
  ○ Causes of Sound Sensitivity
  ○ Neuroscience of Sound Sensitivity
5 Point Holistic Approach: Step by Step

1. Source: Counsel
2. Habituation/Desensitization + CBT: Counsel
3. Sound Therapy: Treatment
4. Distraction: Treatment
5. Diet, Lifestyle, Sleep, Cure: Treatment
Source

• Sound sensitivity counseling: comparable to tinnitus counseling
  ▪ Discuss auditory system; normal hearing; non-auditory regions of brain involved in sound processing (limbic system, basal ganglia, pre-frontal cortex); reaction is a conditioned response, and that can be deconditioned to a neutral stimulus
  ▪ Understand that response to sound is both physiological and influenced by psychological state
  ▪ For misophonia: Discuss aversive sound research, discuss similarities to an external tinnitus
  ▪ Family affair
1. Sounds enter the ear

2. Tiny middle ear bones amplify sound

3. Cochlea sorts sounds by frequency

4. Nerve passes signal from cochlea to brain stem

5. Signal travels through brain getting decoded along the way

6. Auditory cortex recognizes, processes sound
Summary on Hearing and Hearing Loss

- We hear with our brain not our ears
- The most common type of hearing loss is high frequency sensorineural hearing loss
- When hearing loss occurs are brain changes (neural plasticity) to try to compensate
  - This can result in?
Sound Sensitivity

- Normal Loudness Perception
- Abnormal Loudness Perception

Misophonia
- Phonophobia
- Sensory Processing Disorder

Hyperacusis
- Recruitment
- Dizziness, autophony
- Pain
**SS Theory**

- **Hyperacusis**
  - Central Gain
  - Recalibrate System with sound
SS Theory

- Misophonia
  - Central non-auditory regions
  - Creation of conditioned reflex
  - External Tinnitus analogy

Mirz et al. 2000
Focusing of attention

- Hearing loss and other hearing disorders
- General arousal level
- Concurrent attentional process
- Dysfunction of central processing

Tinnitus perception

Failing of sensory and emotional habituation

Tinnitus-related annoyance, discomfort, and suffering

Dysfunctional appraisal, evaluation

- Non/false information
- Catastrophizing
- Worry

Dysfunctional coping

- Low self efficacy
- Resignation
- Withdrawal etc.

Operant factors (avoidance behaviour)
5 Point Approach

- **Source**: Counsel
- **Habituation/Desensitization and Cognitive Restructuring**: Counsel
- **Sound Therapy**: Treatment
- **Distraction**: Treatment
- **Diet, Lifestyle, Sleep, Cure**: Treatment
Habituation/Desensitization

- When a new stimulus becomes “well known” and loses relevance, habituation can fail when associated with a negative evaluation.
- Brain does this all the time!
  - Shoes on feet
- It is the brain’s natural process to habituate to meaningless stimuli: this is why a doctor may tell a patient they will grow out of it.
- Sound is subjective
  - Learned positive and negative associations based on experiences
- Recalibrate altered gain
Habituation

- Definition of conditioning
- Can do the same with sound
  - Airport
  - Train
  - Clock
  - Air conditioning, fan, etc.
Cognitive Restructuring

- Identify and correct maladaptive thoughts and behaviors
- What is the patient’s perception of tinnitus
- Do they display cognitive distortions: e.g. all or none thinking, jumping to conclusions, disqualifying positive
- Help identify alternative thoughts and behaviors
- For example, patient stops going to concerts because of tinnitus
Progressive Muscle Relaxation (PMR):

- PMR consists of alternating deliberately tensing muscle groups and then releasing the tension. Focus on the muscle group; for example, your right foot. Then inhale and simply tighten the muscles as hard as you can for about 8 seconds. Try to only tense the muscle group that you are concentrating on. Feel the tension. Then release by suddenly letting go. Let the tightness and pain flow out of the muscles while you slowly exhale. Focus on the difference between tension and relaxation.

  - head (facial grimace)
  - neck and shoulders
  - chest
  - stomach
  - right upper arm
  - right hand
  - left upper arm
  - left hand
  - buttocks
  - right upper leg
  - right foot
  - left upper leg
  - left foot

- Relax for about 10-15 seconds and repeat the progression. The entire exercise should take about 5 minutes.

- DO NOT DO IF YOU HAVE HIGH BLOOD PRESSURE

Sweetow, 2014
Deep breathing:

- This is the simplest of the relaxation procedures. It simply requires you to follow the five suggestions above and to add deep, rhythmic breathing. Specifically, you should complete the following cycle 20 times:
  - Exhale completely through your mouth;
  - Inhale through your nose for four seconds (count "one thousand one, one thousand two, one thousand three, one thousand four");
  - Hold your breath for seven seconds;
  - Exhale through your mouth for eight seconds;
  - Repeat the cycle 20 times
- The entire process will take approximately 7 minutes.

Sweetow, 2014
CBT/DBT

- Can be very helpful even without sound therapy
  - Biofeedback, some success reported with misophonia
  - Relaxation techniques
    - Breathing and Imagery (see ATA website)
    - Yoga, Tai Chi
  - Other adjunctive therapy, e.g. Cognitive Behavioral Therapy
    - Sound Sensitivity and Depression/Anxiety?
    - Hyperarousal
- Do not make a central part of your life, it shouldn’t be
  - Internet searches, chat rooms, on search for the cure!
  - How can you habituate to something you are focused on.
  - Can create new triggers
5 Point Approach

- Source: Counsel
- Habituation and Cognitive Restructuring: Counsel
- Sound Therapy: Treatment
- Distraction: Treatment
- Diet, Lifestyle, Sleep, Cure: Treatment
Adaptive plasticity of loudness induced by chronic attenuation and enhancement of the acoustic background (L)

C. Formby1, L. P. Sherlock1 and S. L. Gold1

FIG. 2. Two-week treatment effects as a function of ear and stimulus frequency. Group mean changes (+ or −1 standard error bars) in categorical loudness judgments at termination of the noise instrument and earplug treatments for the left and right ears relative to pretreatment baseline sound levels (0 dB) measured for the 500-Hz (left panel) and 2000-Hz (right panel) narrow tones. Baseline standard error of measurement (not shown) across all subjects, loudness categories, and test frequency conditions averaged 2.49 dB.
Sound Therapy

• Taper off Hearing Protection Devices, I do not recommend getting the patient started with them (IMHO): how use lower attenuation devices in steps, or shorter duration of use until no longer using
Sound Therapy

- Sound therapy (Henry et al., 2005)
  - Gradually increase level
- Desentizitation
  - Koegel et al. (2004)--- paradigm to densensitize children with autism to sounds

Table 1
Systematic Desensitization Hierarchy for Lori

<table>
<thead>
<tr>
<th>Step #</th>
<th>Hierarchy Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Toilet is not flushed while Lori walks by the bathroom door. The bathroom door is closed completely.</td>
</tr>
<tr>
<td>2</td>
<td>Toilet is not flushed while Lori walks by the bathroom door. The bathroom door is slightly cracked.</td>
</tr>
<tr>
<td>3</td>
<td>Toilet is not flushed while Lori walks by the bathroom door. The bathroom door is 1/4 way open.</td>
</tr>
<tr>
<td>4</td>
<td>Toilet is not flushed while Lori walks by the bathroom door. The bathroom door is 1/2 way open.</td>
</tr>
<tr>
<td>5</td>
<td>Toilet is not flushed while Lori walks by the bathroom door. The bathroom door is completely open.</td>
</tr>
<tr>
<td>6</td>
<td>Toilet is flushed repeatedly while Lori is approximately 75 feet from the bathroom door.</td>
</tr>
<tr>
<td>7</td>
<td>Toilet is flushed repeatedly while Lori is approximately 50 feet from the bathroom door.</td>
</tr>
<tr>
<td>8</td>
<td>Toilet is flushed repeatedly while Lori is approximately 25 feet from the bathroom door.</td>
</tr>
<tr>
<td>9</td>
<td>Toilet is flushed repeatedly while Lori is approximately 20 feet from the bathroom door.</td>
</tr>
<tr>
<td>10</td>
<td>Toilet is flushed repeatedly while Lori is approximately 10 feet from the bathroom door.</td>
</tr>
<tr>
<td>11</td>
<td>Toilet is flushed repeatedly while Lori is at the bathroom door.</td>
</tr>
<tr>
<td>12</td>
<td>Toilet is flushed repeatedly while Lori is inside the toilet stall. Door to toilet stall is open.</td>
</tr>
<tr>
<td>13</td>
<td>Toilet is flushed repeatedly while Lori is inside the toilet stall. Door to toilet stall is closed.</td>
</tr>
</tbody>
</table>
Sound Therapy

- **Tinnitus Activities Treatment Approach**
  - Have patient provide examples
  - Are there times bothered more or less
  - Educate on mechanism of and theory of hyperacusis
  - Address their concerns regarding experience
  - Keep a diary of loud sounds, reaction, when not too loud
  - Use low level sounds in background with goal of extending period with greater levels
  - Start at comfortable level and increase over several weeks at a perceptual notch at a time
    - Sound should never be loud
    - Patient is in control
    - Limit use of hearing protection to loud sounds only
Sound Therapy

- **Misophonia**
  - Approach based in desensitization paradigms developed for children with Autism (Koegel et al., 2004)
  - Slowly introducing offending sounds with presence of pleasant sound
    - Difficulty is may not only be sound, but visual and sound
    - For example, is the person still effects if they are blindfolded?
    - Trigger Tamer App (Tom Dozier)
      - Misophonia Institute
Sound Therapy

• Treatment-Positive (as in good) Association
  – Introduce offending sounds in positive setting where minimal reaction and patient feels in control
  – Example: 16 y/o hates mom chewing sounds, but wants to spend time with mom. Time for a little retail therapy! Shopping with music with mom, introduce some food with most minimal reaction.

"Shopping is cheaper than a psychiatrist"
Other Therapy

• Not just one approach
  – PATIENT SHOULD BE SEEING THERAPIST, PSYCHOLOGIST, OR PSYCHIATRIST FOR APPROPRIATE THERAPY INCLUDING CBT
  – Occupational therapist: Sensory Diet?
Music and the brain

Playing and listening to music works several areas of the brain:

**Corpus callosum:**
Connects both sides of the brain

**Motor cortex:**
Involved in movement while dancing or playing an instrument

**Prefrontal cortex:**
Controls behavior, expression and decision-making

**Auditory cortex:**
Listens to sounds; perceives and analyzes tones

**Sensory cortex:**
Controls tactile feedback while playing instruments or dancing

**Hippocampus:**
Involved in music memories, experiences and context

**Auditory cortex:**
Listens to sounds; perceives and analyzes tones

**Nucleus accumbens and amygdala:**
Involved with emotional reactions to music

**Visual cortex:**
Involved in reading music or looking at your own dance moves

**Cerebellum:**
Involved in movement while dancing or playing an instrument, as well as emotional reactions

*Source: Music for Young Children*
5 Point Approach: Tinnitus Treatment

- **SOUND THERAPY (General Tips)**
  - Silence is not your friend, have sound around you,
  - Where to start: Environmental sounds, white noise player, MP3 player, CD player, Apps, etc.
    - Play sound as much as possible, but at least several hours per day at about 15 dB SL (you can demonstrate)
    - For misophonia use very pleasant sound
    - For hyperacusis use relaxing sound but not that engages active listening
5 Point Approach: Tinnitus Treatment

- **SOUND THERAPY**
  - What kind of Sound??????
    - White noise, pink noise, modulated, music
    - Continuous (ocean, rain, white noise, pink noise, and etc)
    - Meaningless but relaxing (not actively listen)
    - Do not use a bothersome sound
<table>
<thead>
<tr>
<th>Tinnitus Feature Name/HA Models</th>
<th>Interesting Features</th>
<th>App Available?</th>
<th>App Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Widex</td>
<td>Fractal “color” programs, reputation</td>
<td>No</td>
<td>n/a</td>
</tr>
<tr>
<td>GN ReSound</td>
<td>TSG &amp; nature sounds/Linx2, Enzo, (Verso &amp; Alero w/ phone clip)</td>
<td>Yes, Apple only</td>
<td>No steamer needed to track progress, bubbles calming experience</td>
</tr>
<tr>
<td>Starkey</td>
<td>Multiflex Tinnitus/ Z Series and Xino (RICs only)</td>
<td>16 bands of frequency adjustment</td>
<td>Yes, Apple &amp; Android</td>
</tr>
<tr>
<td>Phonak</td>
<td>Tinnitus Balance/ Bolero, Audeo</td>
<td>Can be used with com accessories, headphone or sound pillows</td>
<td>Yes, Apple &amp; Android</td>
</tr>
<tr>
<td>Signia/Sivantos</td>
<td>Tinnitus Therapy Feature/ All current models</td>
<td>Ocean waves sound, up to 20 bands</td>
<td>Yes, Apple &amp; Android</td>
</tr>
<tr>
<td>Oticon</td>
<td>Sound Support/ Alta2, Nera2, Ria2 Pro Ti models</td>
<td>Ocean sounds</td>
<td>Yes, Apple</td>
</tr>
</tbody>
</table>

Table 1. Comparison of hearing instruments with tinnitus features.

Young et al (2016)
http://misophoniainstitute.org/trigger-tamer-app/
5 Point Approach

- **Source:** Counsel
- **Habituation and Cognitive Restructuring:** Counsel
- **Sound Therapy:** Treatment
- **Distraction:** Treatment
- **Diet, Exercise, Sleep, Cure:** Treatment
Attention and Distraction

DISTRACTION

- When you notice or bothered do something positive!
- Try not to actively engage the bothersome sound
  - I can’t just tell you not to think about it
Whatever you do, do not think of a number right now!
Attention and Distraction

○ **Exercises**
  ○ *Switch attention from one stimulus to another*
  ○ *Start with something like the ring on your finger or shoes on feet*
    ○ Forgot your shoes already???
  ○ *Eventually move to trigger sound with caution*
    ○ Incorporate sound therapy and relaxation techniques
    ○ Do so slowly
5 Point Approach

- **Source:** Counsel
- **Habituation:** Counsel
- **Sound Therapy:** Treatment
- **Distraction:** Treatment
- **Sleep, Lifestyle, Diet, Cure:** Treatment
Effects of Sleep deprivation

- Irritability
- Cognitive impairment
- Memory lapses or loss
- Impaired moral judgement
- Severe yawning
- Hallucinations
- Symptoms similar to ADHD
- Impaired immune system
- Risk of diabetes Type 2

- Increased heart rate variability
- Risk of heart disease
- Increased reaction time
- Decreased accuracy
- Tremors
- Aches

Other:
- Growth suppression
- Risk of obesity
- Decreased temperature
5 Point Approach: Sleep

- **SLEEP HYGIENE**

  - **Sleep is critical,**
    - No Naps, Bedroom = Sleep, Exercise (but not right before bed), Healthy Diet
    - Sound Pillow
    - Melatonin (run by physician)
Table 3

Sleep Hygiene

- Try to maintain a regular bedtime and waking time, even on weekends.
- Avoid napping.
- Use the bedroom only for sleep or sexual activity.
- Keep the bedroom environment cool, quiet, and dark. Avoid bright-light exposure during the night.
- Develop a relaxing bedtime routine. Avoid strenuous exercise or stressful activities before bedtime.
- Do not drink caffeine-containing beverages after noon; eliminate them if possible.
- Avoid heavy meals just before bedtime, a light bedtime snack may be helpful.
- Reduce fluid intake for several hours before bedtime to decrease the need to urinate during the night.
- Regular exercise, particularly during the late afternoon or early evening, may help to promote sleep. A hot bath or sauna at least several hours before bedtime may also be helpful.
- Avoid alcohol or nicotine use prior to bedtime.
- Turn the clock face away and do not check the time if you wake up at night.
5 Point Approach: Lifestyle

- **BE ACTIVE**
  - Physical activity associated with lower levels of tinnitus severity (Carpenter-Thompson et al. 2015)
  - Adolescents and adults with higher physical activity were less likely to report tinnitus (Loprinzi et al. 2013)
  - No word on sound sensitivity, but why not
You Are What You Eat?

by D.R. Smith

I ate a broccoli
and feel tall as a tree

I ate a walnut
and feel like a brain

I ate a mushroom
and I hate this game
FOCUS ON FRUITS
Fruits may be fresh, canned, frozen, or dried, or 100% juice. Make half your plate fruits and vegetables.

VARY YOUR VEGETABLES
Include dark green, red, orange, beans and peas, starchy, and other varieties.

MAKE AT LEAST HALF YOUR GRAINS WHOLE
Eat more whole grains such as whole wheat, bulgur, oatmeal, whole cornmeal, and brown rice.

GO LEAN WITH PROTEIN
Choose from a variety of meat, poultry, seafood, beans and peas, eggs, soy foods like tofu, nuts and seeds.

GET YOUR CALCIUM RICH FOODS
Choose fat-free or low-fat milk, yogurt and cheese.
Figure 1. A. High frequency (HFPTA) and B. low frequency pure-tone average (LFPTA) and healthy eating index quintiles.
Spankovich & Le Prell (2014)
### Demographics NHANES 1999-20002 (Mean data)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SEM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>40.70 (0.33)</td>
</tr>
<tr>
<td>HFPTA</td>
<td>16.29 (0.42)</td>
</tr>
<tr>
<td>LFPTA</td>
<td>9.3 (0.21)</td>
</tr>
<tr>
<td>HEI</td>
<td>63.11 (0.36)</td>
</tr>
</tbody>
</table>

### Demographics NHANES (1999-2002) (Percent data)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Percent (SEM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tinnitus (Yes)</td>
<td>21.2 (1.1)</td>
</tr>
<tr>
<td>Persistent Tinnitus (Yes)</td>
<td>11.7 (0.9)</td>
</tr>
<tr>
<td>Male</td>
<td>40.9 (1.4)</td>
</tr>
<tr>
<td>Female</td>
<td>59.1 (1.4)</td>
</tr>
<tr>
<td>Diabetes (Yes)</td>
<td>5.6 (0.6)</td>
</tr>
<tr>
<td>Hypertension (Yes)</td>
<td>19.8 (0.9)</td>
</tr>
<tr>
<td>Loud Job (Yes)</td>
<td>21.6 (1.1)</td>
</tr>
<tr>
<td>Recreational Noise (Yes)</td>
<td>22.6 (1.1)</td>
</tr>
<tr>
<td>Firearm Noise (Yes)</td>
<td>6 (0.7)</td>
</tr>
<tr>
<td>Smoker (at least 100 cigarettes) (Yes)</td>
<td>47.0 (1.6)</td>
</tr>
<tr>
<td>Veteran (Yes)</td>
<td>9.9 (0.8)</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>69.2 (2.1)</td>
</tr>
<tr>
<td>Other</td>
<td>12.2 (1.3)</td>
</tr>
<tr>
<td>Black</td>
<td>11.1 (1.3)</td>
</tr>
<tr>
<td>Mexican</td>
<td>7.5 (0.9)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>17.3 (1.1)</td>
</tr>
<tr>
<td>High school or equivalent</td>
<td>24.0 (1.2)</td>
</tr>
<tr>
<td>More than high school</td>
<td>58.7 (1.7)</td>
</tr>
</tbody>
</table>
### Any Tinnitus

<table>
<thead>
<tr>
<th>Model</th>
<th>Mean HEI (SEM; CI) Tinnitus</th>
<th>Mean HEI (SEM; CI) No Tinnitus</th>
<th>Wald-F</th>
<th>Sig.</th>
<th>Wald-F: Tinnitus</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>62.64 (0.83; 60.95-64.34)</td>
<td>63.23 (0.39; 62.44-64.03)</td>
<td>0.435</td>
<td>0.518</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>62.76 (0.79; 61.15-64.37)</td>
<td>63.21 (0.36; 62.48-63.94)</td>
<td>6.32</td>
<td>&lt; 0.001</td>
<td>0.251</td>
<td>0.620</td>
</tr>
<tr>
<td>3</td>
<td>62.98 (0.82; 61.31-64.66)</td>
<td>63.15 (0.36; 62.42-63.88)</td>
<td>5.82</td>
<td>0.001</td>
<td>0.031</td>
<td>0.861</td>
</tr>
</tbody>
</table>

### Persistent Tinnitus

<table>
<thead>
<tr>
<th>Model</th>
<th>Mean HEI (SEM; CI) Tinnitus</th>
<th>Mean HEI (SEM; CI) No Tinnitus</th>
<th>Wald-F</th>
<th>Sig.</th>
<th>Wald-F: Tinnitus</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60.67 (1.12; 58.38-62.96)</td>
<td>63.43 (0.41; 62.60-64.26)</td>
<td>5.042</td>
<td>0.033</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>60.75 (1.11; 58.47-63.03)</td>
<td>63.43 (0.37; 62.68-64.18)</td>
<td>8.340</td>
<td>&lt; 0.001</td>
<td>4.60</td>
<td>0.041</td>
</tr>
<tr>
<td>3</td>
<td>61.23 (1.16; 58.85-63.62)</td>
<td>63.36 (0.36; 62.63-64.10)</td>
<td>9.439</td>
<td>&lt; 0.001</td>
<td>2.66</td>
<td>0.114</td>
</tr>
</tbody>
</table>

Model 1 = Tinnitus and HEI  
Model 2 = Model 1 + age, sex, race, education, diabetes, hypertension, smoking, noise, and veteran status  
Model 3 = Model 2 + high frequency, low frequency PTA
5 Point Approach: Diet

- **HEALTHY DIET**
  - Health living-Diet and Exercise *(get physician approval)*
  - Eat healthy-Nutrient Dense: diet rich in green leafy vegetables, onions, mushroom, broccoli, berries, seed & nuts, tomatoes, colored veggies. Eat much as you want!
  - Make protein your side dish: grass fed beef and skinless chicken breast
5 Point Approach: Diet

○ HEALTHY DIET
  ○ Avoid: fried food, processed foods (including deli meats), reduce dairy intake, and reduce white foods (white flour, white rice, white pasta, white potatoes, white sugar)
  ○ Basically eat lots of whole fruits and veggies, reduce high glycemic index foods
  ○ Eat good amount of protein but not too much!
  ○ TALK WITH A NUTRITIONIST/DIETITIAN
5 Point Approach

• What can you advise your patients?
  – Currently no drug or dietary treatment is approved by the FDA for hearing loss prevention
  – But, eating a healthy diet and exercise as approved by their primary care physician is not going to hurt!
EAT LESS CRAP:
C - Carbonated Drinks
R - Refined Sugars
A - Artificial Sweeteners & Colors
P - Processed Foods

EAT MORE FOOD:
F - Fruit & Veggies
O - Organic Lean Protein
O - Omega 3 Fatty Acids
D - Drink Water
Audiologist role as part of TEAM is to provide differential diagnostics, counseling on auditory pathway and how the brain process and reacts to sound, and sound therapy based recommendations (that should be the limit of our involvement, in my opinion)
The misunderstood Misophonia

By Christopher Spankovich and James W. Hall III
Any Questions?
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