Treating Tinnitus/Hyperacusis: A multi-modality approach
LEARNING OBJECTIVES

1. Terms: Tinnitus, Hyperacusis, Misophonia
2. How to Perform A Tinnitus Evaluation
3. Neurophysiological Model of Tinnitus
4. Treatment using Sound Therapy/Stress Management
Definitions

1. **Tinnitus**
   - Ringing in the ears" or another noise that seems to originate in the ears or head.

2. **Hyperacusis**
   - Sensitivity to sound as measured with Loudness Discomfort Measures. The outer hair cells are overreacting, usually a result of virus/head injury or long term tinnitus.

3. **Misophonia**
   - Fear or dislike of certain sounds in certain environments.
Causes of Tinnitus

- Blood vessel disorder
- Head and neck tumor
- Atherosclerosis
- High blood pressure
- Turbulent blood flow

- Malformation of capillaries
- Medications
- Exposure to loud noise
- Ear wax blockage
- Changes in ear bones
- Meniere’s disease

- Stress
- Age related hearing loss
- Depression
- Head/neck injuries
- Acoustic neuroma
Somatosensory Tinnitus:

Does patients tinnitus change with teeth clenching or head/neck movement?

**Point 1**
Tinnitus usually seen around 2K (80)dB
- Trigeminal nerve goes to cochlear nuclei: affected by clenching jaw
- Cervical nerve also goes to cochlear nucleus, affected by head and neck muscles.

**Point 2**
Can alter levels of hyperactivity in cochlear nucleus if you stimulate the trigeminal or cervical nerve.

**Management**
Myofascial release; physical therapy for head, neck, jaw; stress management; awareness of clenching of the teeth.
Osteopathic Dr. Visit, Massage
Tempomandibular Joint Dysfunction

Jaw joint muscles can go into spasm causing pain and dysfunction in the joint.

It shares a nerve supply with the ear canal causing pain to be referred to the ear.

This is the most common cause of ear pain in children and adults.

It often accompanies Tinnitus.

Jonathon Hazel ITHS Newsletter
The tensor tympani muscle contracts and pulls the eardrum inward slightly. It feels or sounds like there is a bug or insect in the ear.

If the person is tense, the muscle can twitch creating a sensation of fluttering of the eardrum.

Stress Management Can Help
Stapedial Myclonus

**Definition**
- Pulsatile Tinnitus not tied to heatbeat
- Stapedius muscle goes into spasm
- Shows as a repetitive beat on acoustic reflex testing.

**Treatment**
Refer to ENT if bothersome. The muscle could be cut.
Palatal Myoclonus

Irregular clicking sounds emanate from the ear and may be heard by others. Refer To ENT if Bothersome
Pulsatile Tinnitus

Point 1:
• Is it synchronous with the heartbeat

Point 2:
• Is it Unilateral

Refer to ENT
Suggested tests/causes as outlined in TRI flow chart

Medical Exams
Neuro-Vascular Exam, Echo-doppler, Angiography, Angio-MRI, Blood test

Possible Causes
Arteriovenous malformations, sinus thrombosis, Aneurysm, Glomus tumor, Carotid Stenosis, BHI, Sinus Thrombosis, High Jug. Bulb, Overcrowding, Chiari
Testing Procedures

1. THI, TRQ, Initial interview
   • Diagnostic Audiogram (AC, BC, speech)

2. Tinnitus pitch/loudness match
   • LDL testing for speech and pure tones
   *DO NOT CONTINUE IF LOW LDLS*

3. Tympanogram/Acoustic Reflex testing
   • DPOAE
Case History Forms

- Thorough Case History
- Tinnitus Handicap Inventory
- Tinnitus/Hyperacusis Initial Interview
- Becks Depression Inventory
- Tinnitus Impairment Questionnaire
- Tinnitus Severity
- WHOQOL-BREF
Tinnitus Evaluation

1. **Otoscopic Inspection** (ear wax impaction, hair touching ear drum, etc)

2. **Diagnostic Audiometry** (PT Air, Bone, Speech)
   (look for the obvious, asymmetry etc.)

3. **UCLs for speech and pure tones**
   (looking to see if below 90dBHL for one or the other, or both)

4. **Tympanometry and Acoustic Reflexes**
   (looking for repetitive beats on either the tymp or reflex)

5. **DPOAE out to 12kHz** (especially with normal hearing)
Diagnostic Process

1. Match to PT or NBN
2. Pitch Match & Loudness Match
3. Threshold for NBN
4. Masking level for NBN
5. Present masking level for 1 minute
   Any residual inhibition?

CPT CODE: 92625
Interpretation of LDLs

Patients without problems with sound tolerance have an average LDL of about 100dBHL.

Patients with clear sound tolerance problems have average LDLs below 90dBHL.
“Strain to Hear” Phenomenon

When people think their tinnitus is making them not able to hear

When a patient is focusing attention on an attempt to understand speech because of their tinnitus, there is an induced activation of the autonomic nervous system and potential enhancement of gain within the auditory system, typically increasing tinnitus.
Heller & Bergman

1953- Heller and Bergman put 80 individuals without tinnitus in a sound proof booth. They were asked to report “any sounds they might hear”

Within 5 min, 94% reported buzzing, pulsing, whistling sounds identical to sounds reported by tinnitus sufferers

Tinnitus is not necessarily the result of pathology
Loss of Hair Cells and Normal Hearing

- Up to 30% of OHC can be lost w/o affecting the audiogram

- We all lose OHCs from birth at a rate of ½% per year

- Would cause hearing loss @60 years old
- Many factors can accelerate damage (e.g., loud noise, ototoxic drugs, bacterial and viral infections, autoimmune and other medical disorders, genetic factors
NORMAL THRESHOLDS, TINNITUS MATCHED TO 6kHz, 35dB PT
DPOAE testing shows 6kHz Noise Notch: Same pitch as tinnitus!
### Categories of tinnitus and hyperacusis patients:

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Impact on life</th>
<th>Tinnitus</th>
<th>Subjective hearing loss</th>
<th>Hyperacusis</th>
<th>Prolonged sound induced exacerbation</th>
<th>Treatment (always involves counseling &amp; use of enriched background sound)</th>
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<tbody>
<tr>
<td>0</td>
<td>low</td>
<td>present</td>
<td>--</td>
<td>--</td>
<td>--</td>
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</tr>
<tr>
<td>1</td>
<td>high</td>
<td>present</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>sound generators set at/below mixing point</td>
</tr>
<tr>
<td>2</td>
<td>high</td>
<td>present</td>
<td>present</td>
<td>--</td>
<td>--</td>
<td>hearing aid with stress on enrichment of the auditory background or combination instruments</td>
</tr>
<tr>
<td>3</td>
<td>high</td>
<td>not relevant</td>
<td>not relevant</td>
<td>present</td>
<td>--</td>
<td>noise generators set with extra stress at non-annoyance, or combination instruments</td>
</tr>
<tr>
<td>4</td>
<td>high</td>
<td>not relevant</td>
<td>not relevant</td>
<td>present</td>
<td>present</td>
<td>noise generators set with extra stress at non-annoyance, or combination instruments</td>
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Abbreviations: Hyperacusis - significant sensitivity to environmental sounds typically associated with LDLs below 100 dB HL; Prolonged sound-induced exacerbation of tinnitus / hyperacusis when the effects persists to the following day; Subjective hearing loss - perceived subjectively by a patients 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. Note, sound used for sound therapy should never evoke the annoyance or discomfort!

*Jastreboff, P. et.al (2008) TRT for Management of Tinnitus and Hyperacusis*
The description of tinnitus such as its pitch, loudness, placement, etc has no relation to the level of annoyance evoked by the tinnitus.

75% of people who experience tinnitus are not bothered by it.

10 million people have a severe or debilitating problem because of tinnitus.
ANS acts as a control system functioning mostly below the level of consciousness.

The ANS affects heart respiratory rate, salivation, perspiration, pupillary dilation, urination, and sexual arousal.

Two parts:
1. Sympathetic
2. Parasympathetic

**Autonomic Nervous System**

**Sympathetic Portion**

- **Fight/Flight**
  - Dilates pupil
  - Relaxes bronchi

- **Anxiety**
  - Accelerates heartbeat

- **Chronic Stress**
  - Inhibits digestion
  - Contracts vessels
Autonomic Nervous System

Parasympathetic portion

Rest
- Contracts pupils
- Constricts bronchi

Relaxation
- Slows heartbeat

Calmness
- Stimulates digestion
- Dilates vessels
WHAT WOULD YOU BE THINKING IF THIS WERE YOU?

Are Ants going to crawl on me?

Money worries?

Other stressful thoughts?

The sun feels great!

I love my life.

The grass on my feet is soft.

Focusing on breathing

Meditation

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WORRY: STRESS "WHAT IF…"

Sympathetic: STUCK IN FIGHT/FLIGHT
MEDITATION: CALM BEING IN THE MOMENT

Parasympathetic:
Rest, relaxation
Natural Habituation to a New Sound

Calm, in moment, not stressed out
When sound becomes a problem:

- Auditory Subconscious
  - Thought/Processing

- Limbic system
  - emotions

- Cochlea
  - Source

- Autonomic Nervous System
  - Stress

Worry, fear, afraid, etc
Hyperacusis

Definition

Significant sensitivity to environmental sounds typically associated with LDLs below 90dB

Outer hair cells are over-reacting to sound causing it to seem louder than it really is.
**Misophonia**

**Definition:**
When Sound Causes an Emotional Reaction

- Usually associated with hyperacusis but may occur alone.
- If UCLs to speech are low, but normal for pure tones: Misophonia only. Outer Hair cells are NOT affected.
Medical Problems linked to Decreased Sound Tolerance

- Tinnitus
- Lyme Disease
- Williams Syndrome
- Bell’s Palsy
- Stapendectomy
- Head Injury
- Migraine
- Depression
- Ramsay Hunt Syndrome
- Perilymphatic fistula
- Withdrawal from benzodiazepines
- Increased cerebral spinal fluid pressure
- Addison’s disease
Many patients with Brain injury have sound sensitivity.

Google: Mayo Clinic, Traumatic Brain Injury

Brain Injury patients have a lot of nuances that you must be aware of if you are to treat them. You must take very small steps!
Autism & Sound Sensitivity

1. same functioning sensory filters to block out noise.

2. hearing protection; vented, non-vented, musician earplugs, anti-hearing aids.
Impact of Decreased Sound Tolerance on Patient’s Health

- Prevents patients from exposing themselves to louder environments
- Reduces social interaction
- Affects work
- In extreme cases controls patient’s life
MUST TREAT HYPERACUSIS FIRST - before treating Tinnitus/Hearing Loss

Use of broadband sound set very low, (if sound generators set them 6dB above threshold as seen on verifit. Use Live speech and don’t talk during the recording. If combo unit, turn off mic to test the sound.

DO NOT USE EAR PLUGS or wean off them.

(* special protocol for autistic patients and brain injury patients.)

Retest in six weeks: Looking for improved LDLs.

If misophonia is present combine music protocol along with therapy for obsessive/compulsive disorder, stress management.
Treating Misophonia/Phonophobia

MUSIC PROTOCOL

Have patient pick out music that they enjoy. Listen to it at a comfortable level for 20 minutes each day. Do nothing else for 1 week

2nd week: increase volume one noticeable notch

3rd week: increase volume 2 noticeable notches
Repeat cycle
Additional Treatment for Misophonia

- Psychologist
- Stress Management
- Hearing Protection as needed
- Sound Therapy
- EFT
Tinnitus signal in silence

Overtime the tinnitus signal can reduce to a point where you don’t notice it unless you pay attention to it without the use of sound therapy.

Perception of loudness is less. The signal did not change,

Low level broadband noise

Tinnitus with sound therapy set low (habituation)

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HABITUATION: Using sound therapy set to low level versus masking

In silence rate your tinnitus on a scale of 1 to 10. Now if we add some broad band sound, set very low so you can barely hear it, rate your tinnitus again. For most, the sound of the tinnitus diminishes to a lower number. We are not trying to make the tinnitus disappear!

The goal is habituation! To train your body not to perceive your tinnitus as loudly and to lessen the subconscious reaction to the tinnitus. Over time, you may no longer need sound therapy.

If we mask your tinnitus (put the broadband sound so loud you can no longer hear the tinnitus), once the sound is gone the tinnitus returns to the same loudness. The body cannot learn to modify its reaction to something it cannot hear.

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Sound Therapy
Different sound therapy options

- Options are: hearing aids, sound machines, environmental noise, neuromonics, ear level sound generators, APPS etc...

- Sound therapy alone will not help you to habituate. Counseling, along with stress management is crucial

- We will help you pick the appropriate sound therapy option for you.
MINDFULNESS

Strive to focus on the present

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Mindfulness

- It is not healthy for your thoughts to be in the past or present all the time.
- Recognize where your thoughts are
- Bring your awareness back to the room you are in.
- The first step is awareness
What is EFT?

The Emotional Freedom Technique is a combined form of Energy Psychology and needle-free Acupuncture in which it is understood that all negative emotions are caused by disturbances in the body's energy system.

EFT is a process in which specific end points of the energy meridians within the body are tapped on creating a pulse of energy resulting in a rebalancing of the emotions.

The Emotional Freedom Technique is great for virtually anything that ails you emotionally or physically, such as releasing phobias, pain (chronic or otherwise), addictions, allergies, anxiety, depression, diseases, trauma including Post Traumatic Stress Disorder (PTSD), weight issues.

Online at www.garythink.com are instructions and videos.
EFT: Emotional Freedom Technique

www.garythink.com

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The art of breathing:

**Inhale:** Take a deep breath and expand the belly as well as your lungs with air. While breathing in, repeat the phrase: "Breathing In I Calm Myself”

**Exhale:** expel all air and make sure to collapse your belly. Smile while repeating “Breathing out I smile!”

Rationale: People who have anxiety/depression tend to breathe shallowly. This can promote more anxiety and stress. Hyperventilation is also possible. By extended the breath into the belly, you are ensuring that you are filling your full lung capacity. By repeating the phrases above will encourage deeper, longer breathes. Smiling at the end releases good endorphins to help calm the body.


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Case Studies
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<tr>
<th>Name</th>
<th>Initial THI</th>
<th>Timeframe</th>
<th>Final THI</th>
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<tbody>
<tr>
<td>Maureen</td>
<td>38</td>
<td>12 weeks later</td>
<td>6</td>
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<tr>
<td>Amanda</td>
<td>70</td>
<td>4 months later</td>
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<tr>
<td>Gary</td>
<td>86</td>
<td>6 months later</td>
<td>32</td>
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<tr>
<td>Brent</td>
<td>66</td>
<td>3 months later</td>
<td>22</td>
</tr>
<tr>
<td>Beth</td>
<td>74</td>
<td>1 ½ years</td>
<td>26</td>
</tr>
<tr>
<td>Jeff</td>
<td>84</td>
<td>2 years later</td>
<td>31</td>
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</table>
TINNITUS HANDICAP INVENTORY

Jan 2009
Severe handicap
88%

March 2009
Mild handicap
24%
Jan 2009
100% aware 100% annoyed
"10" severity, "10" annoyance, "10" effect on life

March 2009
30% aware, 20% annoyed
"7" severity; "5" annoyance, "2" effect on life
TINNITUS FINAL INTERVIEW AFTER TRT THERAPY

July 2009
No Handicap 8%

July 2009
10% aware, 0% annoyed
Pulsatile case example

Pulsatile tinnitus with heartbeat past 5 weeks: Not present during testing

Asymmetric SNHL: 24% discrimination ability in poor ear
Tinnitus described as “squish with heartbeat” in left (poor) ear

Medical: vertigo for 15 years, migraines, high blood pressure, nervousness, anxiety, depression, gout, prostate, tremors

Significant history of noise exposure, both occupational, military and recreational

Referred to ENT for pulsatile tinnitus with letter suggesting certain tests from the TRI flowchart

Findings: MRI showed a benign thornwaldt cyst. MRA showed “a rather oblique take off of the left internal carotid artery with some flow phenomenon artifact.”
Maureen

- 52 year old female: Mail Clerk
- Abrupt beginning, constant hum/buzz
- 100% aware, 100% annoyed  THI=38
- Hearing is WNL sloping to moderate HF SNHL at 6-8kHz. Tinnitus matched to an 8k PT/NB bilat. No residual inhibition. Normal UCLs.
- Treatment: fit with sound generators; counseled on stress management

- 6wk f/u THI = 16, reports low stress level
- 12 wk. f/u  THI= 6  No longer wears sound generators
True Hyperacusis?

- Jennifer A. after 7 mo. on sound generators

UCL testing/FU

NO IMPROVEMENT

10 min later: post medication

“Cured”!? 
Hyperacusis and Phonophobia Example

- Case study 5: Beth
- LDLs 50-70DB, Tinnitus at 3k, UCL to speech =65dB, THI = 74
- 5 months later:
- THI=26, LDLs improved to near normal levels

*Treatment: sound generators, TRT counseling, extensive stress management counseling, music protocol, EFT tapping for anger issues associated with sound*
Tinnitus/Hyperacusis Training Class Using Multiple Modalities

2 Full Days Albany NY
January 12-13, March 9-10,
Cost: $900 includes meals, materials, forms
Airfare/Hotel separate.

Maximum of 10 people: RESERVE NOW
518-283-6111 or email erin@audiologicsolutions.org

HANDS ON TRAINING in diagnosis, and treating using the multi-modality approach. You will leave this course with all the materials needed to start seeing and treating your own tinnitus/hyperacusis patients. Special emphasis will be placed on misophonia and brain injured patients, as these are treated differently. Stress management, EFT and breathing will also be taught.

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Questions