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Hearing Aid Fitting Parameters for Management of Chronic Bothersome Tinnitus

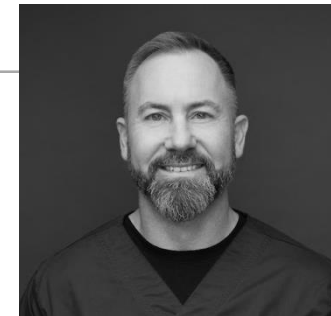
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Dr. Fligor earned his bachelors in biomedical engineering and doctorate in audiology from Boston University, and post-doctoral research fellowship at Harvard Medical School. He is board certified in audiology with a specialty in pediatric audiology, and author of Understanding Childhood Hearing Loss (Rowman & Littlefield, Oct 2015). He is adjunct audiology faculty at Salus University (Elkins Park, PA) and at MGH Institute for Health Professions (Boston, MA). He sees patients of all ages, and has special interests in treating sound sensitivity disorders (tinnitus and hyperacusis) and noise-induced hearing loss, particularly in musicians.

Disclosures

- **Presenter Disclosure: Financial:** Brian Fligor is a clinical advisory board member for Neuromod Devices, LTD, the manufacturer of the Lenire tinnitus therapy device. He has received an honorarium for presenting this course. **Non-financial:** Brian Fligor has no relevant non-financial relationships to disclose.
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Learning Outcomes

After this course, participants will be able to:

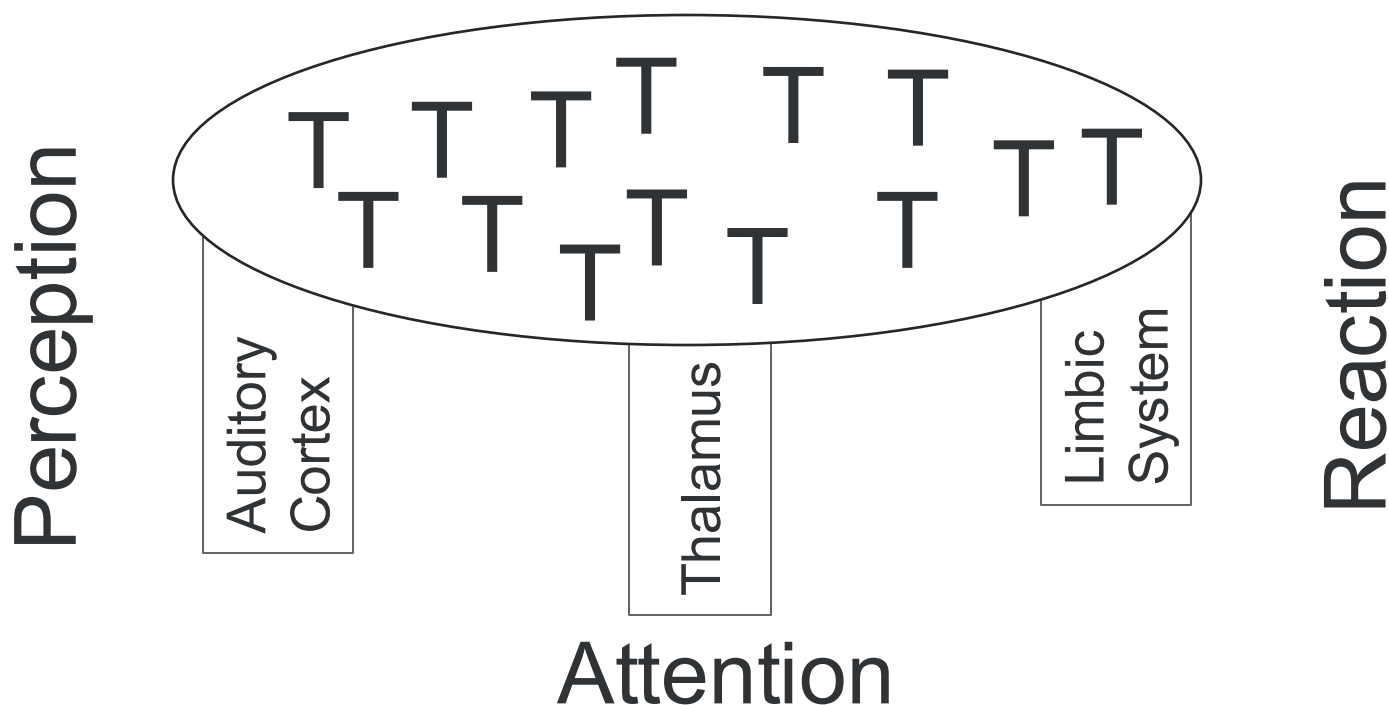
- Explain how to help a patient identify sounds that are vaguely pleasant, but easy to ignore, and therefore more effective at masking tinnitus.
- Explain in patient-appropriate language the reason soft-sound enhancement is an effective treatment for tinnitus symptoms.
- Discuss how to use real ear probe microphone measures to confirm the hearing aid and masking levels are sufficient to help manage tinnitus symptoms.

Agenda

- Introduction: Tinnitus Epidemiology
- An experience of tinnitus and masking
- Evaluating the patient with tinnitus (and hyperacusis)
- Identifying technology features in hearing aids
- Applying masking and amplification
- Illustrative cases
- Summary

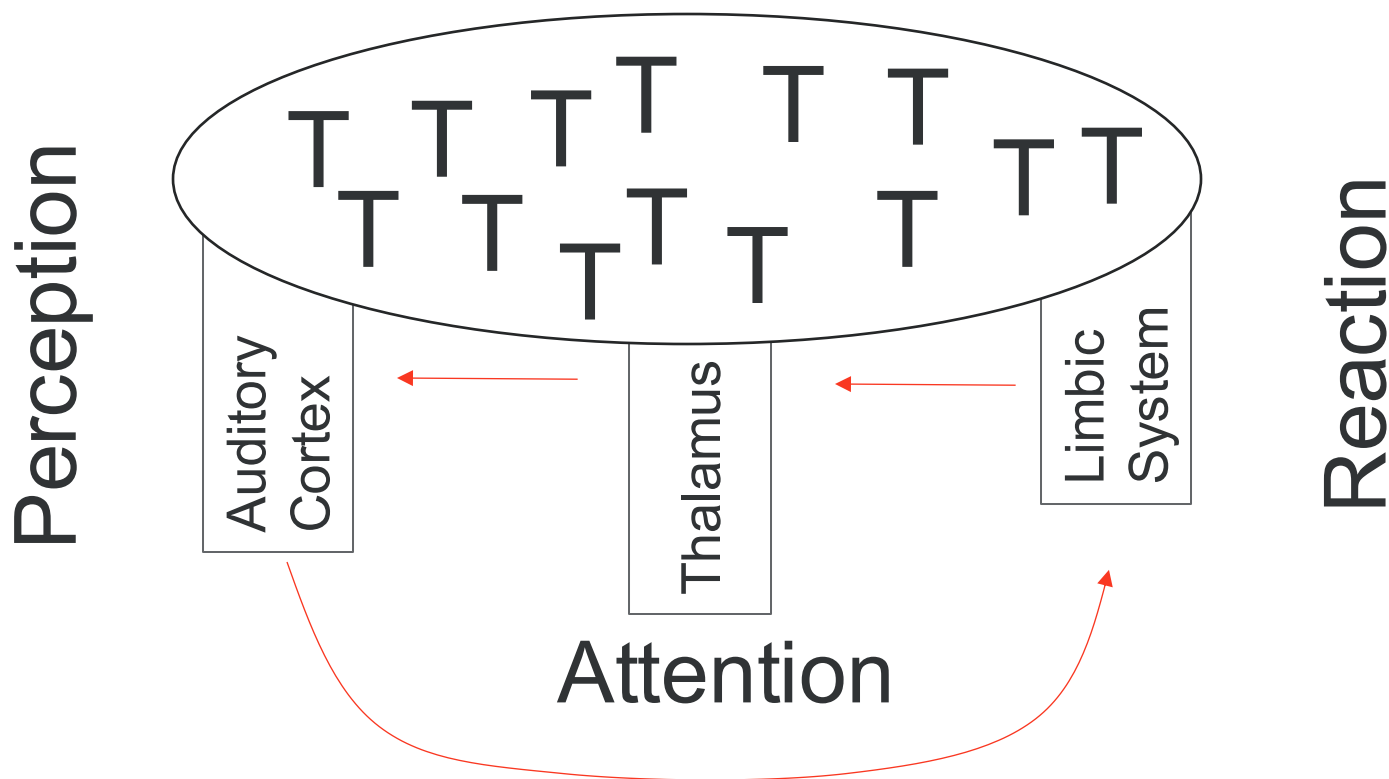
How Patients Experience Tinnitus

- Tinnitus: “Phantom ringing, buzzing, hissing noise in the ears or head in the absence of an external sound source.”



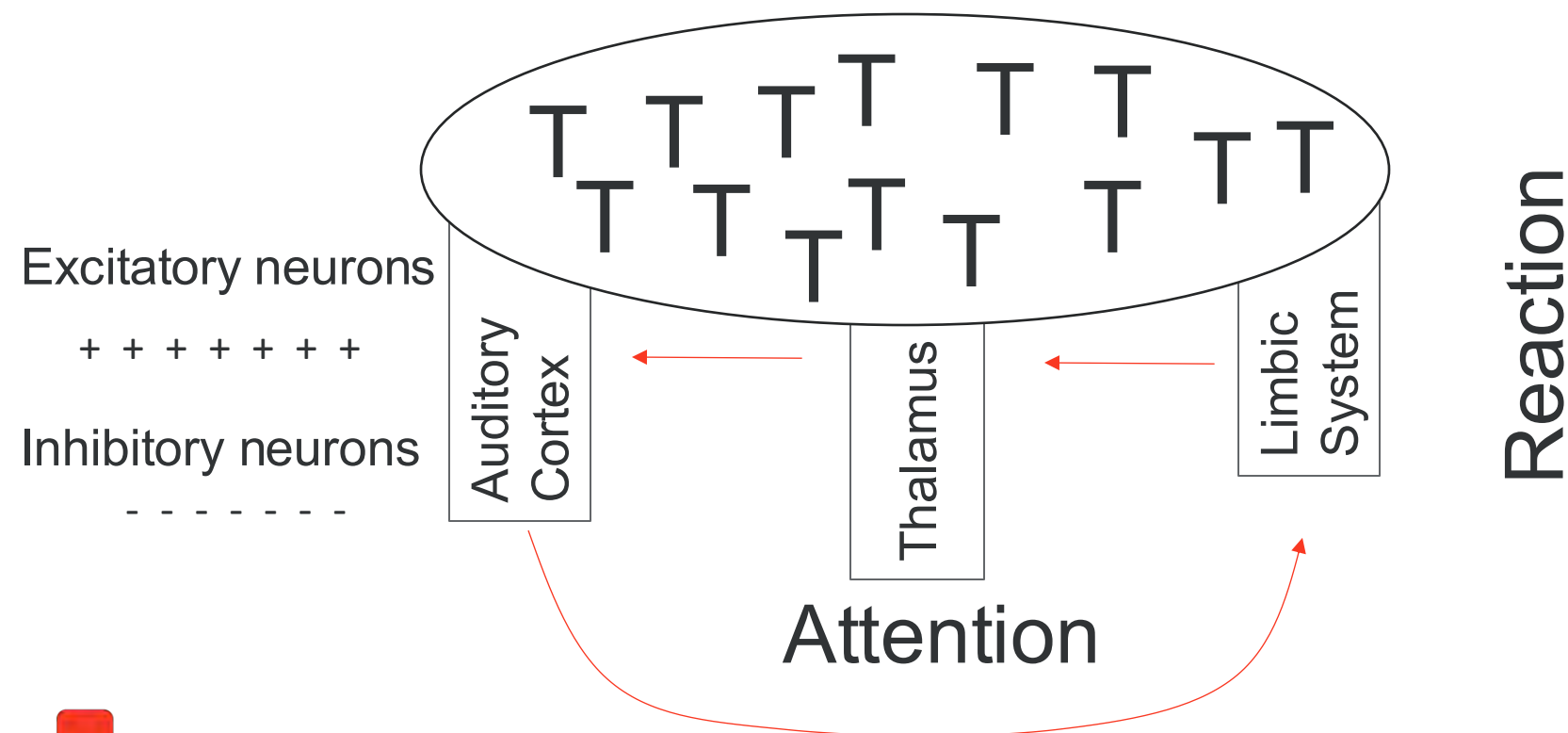
How Patients Experience Tinnitus

- Tinnitus: A sensation... an otherwise benign sensation, except a network of neurons accidentally assigns “threat”



How Patients Experience Tinnitus

- Tinnitus: A sensation... an otherwise benign sensation, except a network of neurons accidentally assigns “threat”



Epidemiology of Tinnitus

According to the American Tinnitus Association:

- 10-15% of the US population (~50M) have tinnitus
 - Jarach et al (2022): 14.1%, prevalence increases with age (and hearing loss)
- 6% of the US population (~20M) have bothersome tinnitus
- 0.6% of the US population (~2M) have debilitating tinnitus

Epidemiology of Tinnitus

According to the American Tinnitus Association:

- 6% of the US population (~20M) have bothersome tinnitus
 - Limbic System activation
 - ~30M have tinnitus that doesn't bother them!
- 0.6% of the US population (~2M) have debilitating tinnitus
 - Limbic System activation, AND Thalamic reflexively gives tinnitus priority
 - Downregulation of inhibitory neural networks in Auditory Cortex

Chronic Bothersome Tinnitus

Associated with:

- Hearing loss (sensorineural, but also conductive)
- Increased sound sensitivity (e.g., hyperacusis)
- Anxiety, depression, and negative repetitive thoughts
- Not typically associated with dizziness (except in Meniere's disease)

Symptoms of Tinnitus

“My Tinnitus”



Ring



Hiss



Buzz



Bothersome Tinnitus?

- Sleep disruption (getting to/maintaining sleep)
- Loss of Control/Persistence of tinnitus (“can’t escape”)
- Anxiety, depression
- Annoyance, irritation, inability to relax
- Difficulty with concentration, or confusion

Tinnitus “Masking”

“My Tinnitus” 

“Masker” 

Tinnitus is not masked “energetically” (like contralateral masking) but “informationally” (like central masking, mediated by the thalamus)

Most important:

- Masker should be **vaguely pleasant, and easy to ignore**
- At a minimum, masker must be less annoying than tinnitus

Assessment of the Patient

- Comprehensive audiometry (pure-tone air-bone and speech)
- DPOAEs (as many frequencies per octave as practical)
- UCL/LDL (highly dependent on instructions)
- Tympanometry
- Acoustic reflex thresholds **if establish trust**, start **very** low level (at or below LDLs)
- Tinnitus Questionnaires (TFI, THI)

Assessment of the Patient

- Psychophysical measures of tinnitus?
 - Pitch and loudness matching?
 - Minimum Masking Level?
 - Residual inhibition?
- Questionnaires! (Reaction, not the perception)
 - Tinnitus Functional Index (Meikle, et al 2012)
 - Tinnitus Handicap Inventory (Newman, et al 1996)

Assessment of the Patient

- Tinnitus Functional Index (Meikle, et al 2012)
 - 8 subdomains associated with tinnitus bother
 - Intrusiveness
 - Sense of Control
 - Cognitive
 - Sleep
 - Auditory
 - Relaxation
 - Quality of Life
 - Emotional
 - Change ≥ 13 pts is significant

Tinnitus Interventions

- “You’ll just have to learn how to live with it.”

Tinnitus Interventions

NO!!!!

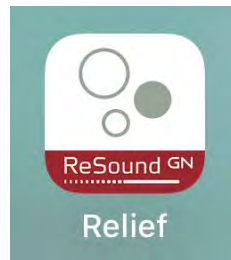
- ~~• “You’ll just have to learn how to live with it.”~~

Tinnitus Interventions

- Sound Enhancement & TRT



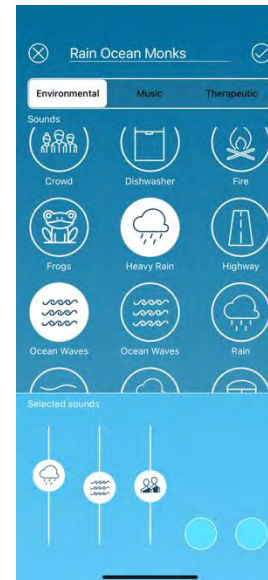
My tinnitus



Sound Enhancement App



Mixed



Tinnitus Interventions

- Management, not a cure
- Habituation of Reaction vs. Habituation of Perception
- Tinnitus Retraining Therapy:
 - Informational Counseling (demystify cause and consequence of tinnitus; Reaction vs. Perception)
 - Never experience tinnitus in absence of masker or other sound
 - Identify minimum masking level, and drop the masker by 1 dB, so tinnitus is *just* audible (“Mixing Point”)
 - Purpose: **facilitate habituation of reaction**

Hearing Aid Fitting Parameters for Tinnitus

- **MUST** have LDLs
- Primary goal, management of tinnitus
- Secondary goal, audibility and improved communication
 - Secondary goal supports Primary goal, if stress secondary to communication challenge is reduced
- Venting per audiogram (err on side of largest possible)
- Emphasis on soft-sound gain (environmental masking)
- Higher-intensity input (and MPO) lower

Hearing Aid Fitting Parameters for Tinnitus

- Emphasis on soft-sound gain
 - **Turn off** noise reduction, by default (or at least decrease)
 - *Do not turn on expansion*
 - 65 dB and 75 dB inputs (medium and high) at or below adult fitting targets
 - Probe mic measures are absolutely key! (demonstrate to sound-sensitive patient gain will not overexpose cochlea)
- Feedback management on
- Impulse/transient noise management on (and make more aggressive)

Hearing Aid Fitting Parameters for Tinnitus

- To turn ON, vs. OFF the onboard tinnitus masking on hearing aids...
 - Fractile noise
 - Notched-noise
 - Shaped-noise, pink, red, white...

NONE of this Matters!!

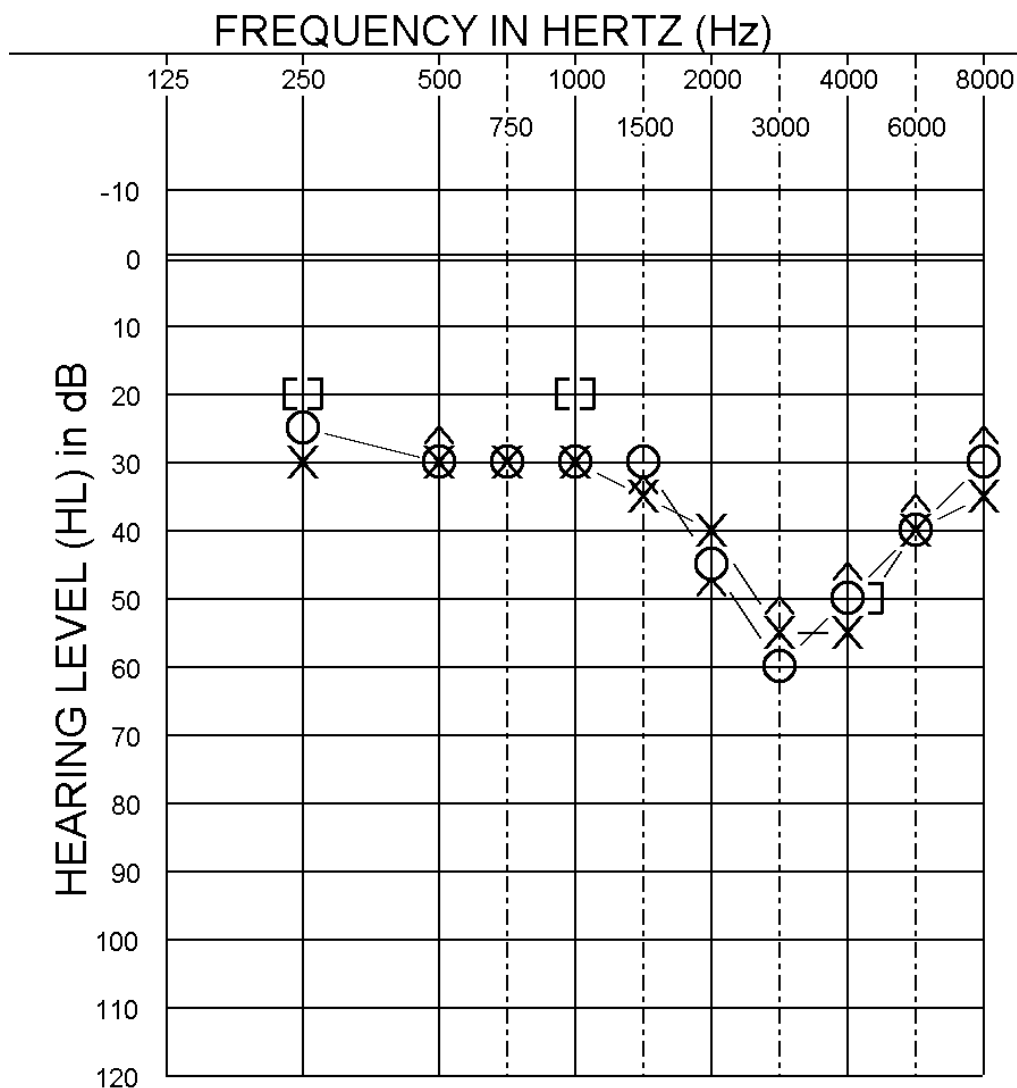
- “Vaguely Pleasant, and Easy to Ignore”
- Masker at least not as annoying as the tinnitus

Hearing Aid Fitting for Tinnitus

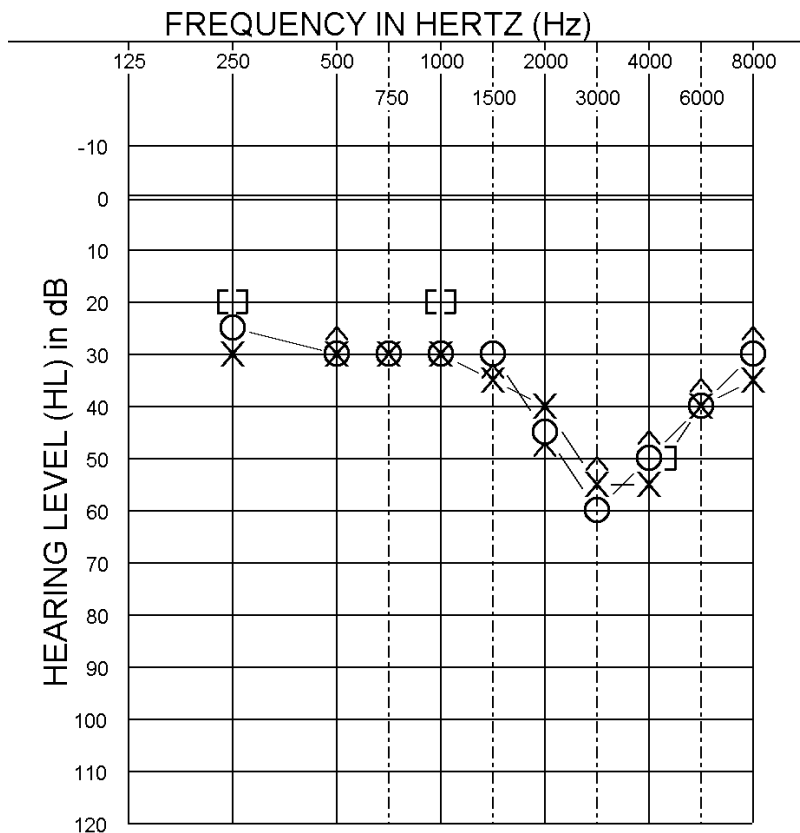
- Onboard masking vs. streamed from smartphone (or computer)
 - Size of device (too small for Bluetooth?)
 - Must have pushbutton on at least some manufacturer CICs
 - Limited choice (onboard) vs. limitless (Bluetooth)

Professional Drummer: worker's compensation claim

- 42 year old male
- Two workplace acoustic trauma events, 5 years prior (within 6 months)
- Fitted with combination tinnitus-masker/hearing aids elsewhere
- Tinnitus most salient complaint (TRQ = 78)
- WRS = 92-100%
- Also hyperacusis (guarding)



Professional Drummer: worker's compensation claim



- Music, no hearing aids



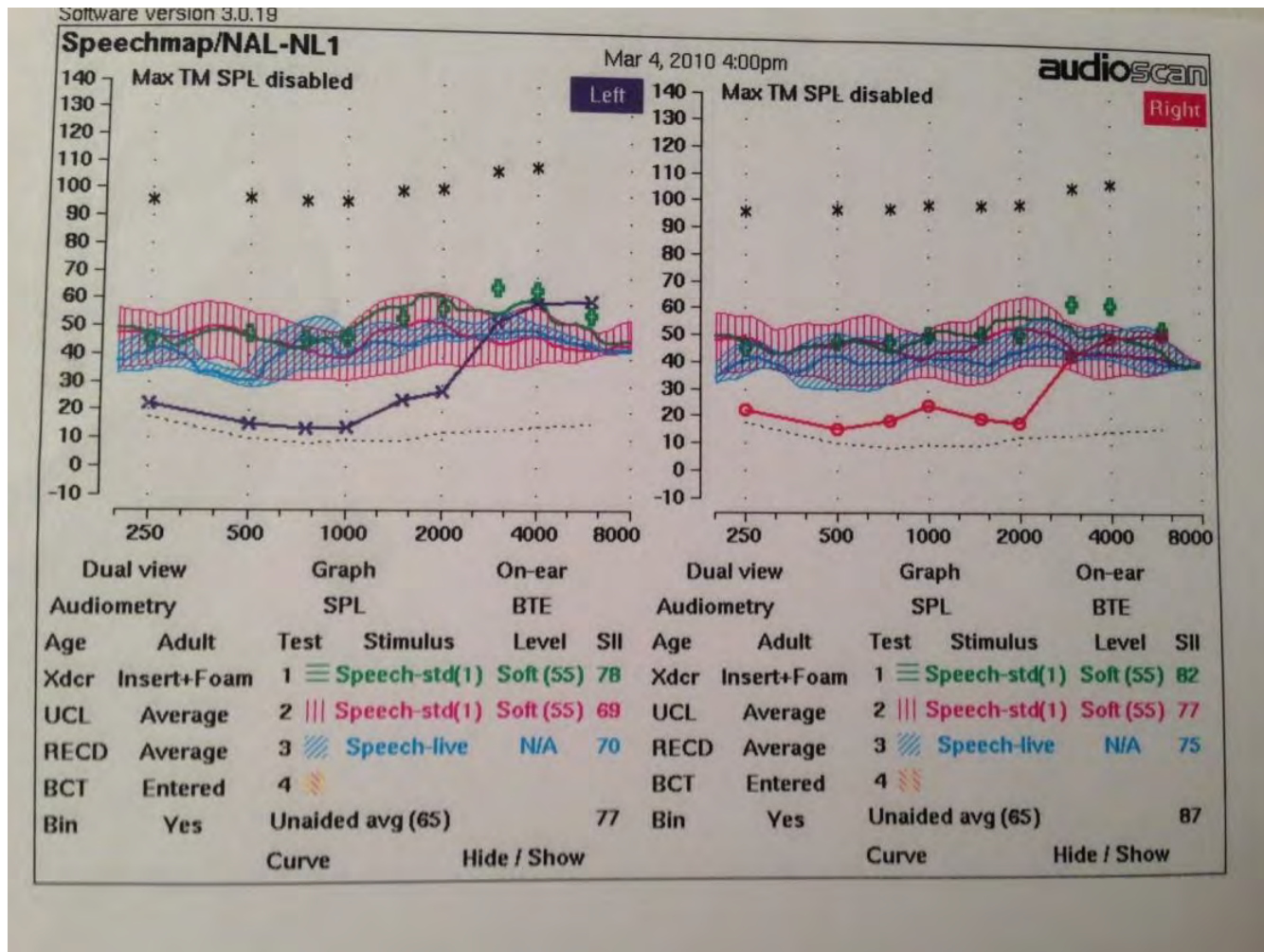
- Music, with hearing aids



- Music, with HAs + Masker



Probe Mic Measures of Masking



Tinnitus Interventions:

Pharmacological

- No medications treat tinnitus, only reaction
- Comorbidities of tinnitus:
 - Anxiety, depression, negative repetitive thoughts
 - Insomnia, attention deficit
- Zoloft (sertraline) and Lexapro (escitalopram); other SSRIs (Prozac)
- Benzodiazepines (Ativan, Klonopin, Valium, Xanax)
- Neurontin (gabapentin, for nerve pain)
- Trazedone, melatonin (sleep)

Summary

- Circle of Tinnitus: “I hear it” → “It’s a threat” → “I can’t ignore it”
- High prevalence, challenging combination of physiological and psychological “pain”
- Diagnosis: hearing test, counseling for hearing conservation, validated tinnitus questionnaires
- Management: Behavioral Health, TRT, Sound Enhancement, psychopharmacology for comorbid psychological conditions
- Hearing aids: Soft-sound emphasis, no noise reduction/expansion, must have LDLs, mode of delivering appropriate masking

Thank you!



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