PRESENTED BY | LAUREN MANN AUD, ABD

SOUND THERAPY FOR TINNITUS: DOING MORE HARM THAN GOOD?

INTERCAMPUS PROGRAM IN COMM SCIENCES AND DISORDERS

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DISCLOSURES

- **Faculty at the University of Kansas**
  Department of Hearing & Speech
- **PHD Candidate at the University of Kansas**
  Auditory Effects of Concussion
- **Complimentary KSHA Registration**
  For speaker agreement

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OBJECTIVES

At the end of the session, participants will be able to:

- **Discuss the pros and cons of sound therapy for tinnitus management with potential patients.**
- **Apply a few basic rules of sound therapy application in patients with tinnitus and hyperacusis.**
- **Monitor the efficacy of sound therapy treatment plans in their patients.**

AGENDA

1. SOUND THERAPY OVERVIEW
2. RISKS AND BENEFITS OF SOUND THERAPY
3. APPLICATION OF SOUND THERAPY
4. OUTCOME ASSESSMENT

DISCLAIMER

YOU WILL NOT LEAVE TODAY'S 90 MINUTE SESSION PREPARED TO LAUNCH A TINNITUS PROGRAM AT YOUR PRACTICE

- Tinnitus Practitioner's Association
- IOWA TINNITUS CONFERENCE
- SALUS TINNITUS CERTIFICATION
- IHS TINNITUS CERTIFICATE

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TINNITUS AND HYPERACUSIS PROGRAM

https://www.salus.edu/Colleges/Audiology/Advanced-Studies-Certificate-Programs/Tinnitus-and-Hyperacusis-Program.aspx

SALUS UNIVERSITY

The program will provide a framework for best practices in the assessment and management of tinnitus and hyperacusis.

The 10.5 semester credit online Advanced Studies in Tinnitus and Hyperacusis Certificate Program is designed to:

- Provide specialized training to expand clinician's knowledge of tinnitus (ringing in the ears) and hyperacusis (hypersensitivity to sound).
- Enhance the skills and expertise necessary to obtain a comprehensive and holistic understanding of the pathology and consequences of tinnitus and hyperacusis.
- Bring the professional up to date on the contemporary evidence that provides scientific support for treatment decisions for those with tinnitus and hyperacusis.

IHS TINNITUS CERTIFICATE

https://www.ihsinfo.org/IhsV2/tinnitus/

The International Hearing Society is proud to present the

Tinnitus Care Provider Certificate Program

November 8-9, 2019
Marriott Chicago O'Hare Airport
Chicago, Illinois

The Tinnitus Care Provider Certificate Program is a two-day workshop and assessment to learn how to help your patients with tinnitus. This comprehensive curriculum focuses on tinnitus patient care involving physiology, psychology, measurement, management, and practice organization. A Tinnitus Care Provider certificate will be awarded only to those participants who attend the workshop and meet the passing standard of the assessment.

IOWA TINNITUS CONFERENCE

https://medicine.uiowa.edu/oto/education/conferences-and-events/international-conference-management-tinnitus-and-hyperacusis

Management of the Tinnitus & Hyperacusis Patient

27TH ANNUAL INTERNATIONAL CONFERENCE

The University of Iowa

June 13-14, 2019

FOR PROFESSIONALS AND PATIENTS

Department of Otolaryngology - Head and Neck Surgery
Department of Communication Sciences and Disorders

Professional Resources

The American Tinnitus Association is pleased to offer resources to tinnitus health providers.

Find a Healthcare Provider

Use ATA's Health Professional Directory to find a local doctor with experience in tinnitus management and support.

Learn More

SOUND THERAPY OVERVIEW

What Is Sound Therapy?

Definition is not clear…. but it could include any combination of

Environmental Enrichment

Masking

TRT / Habituation Therapy

WHY SOUND THERAPY?

TINNITUS: Brain perception of sound in the absence of real acoustic stimuli to the auditory system (Hobson et al 2012)

TINNITUS Affects 5-43% of the general population (McCormack 2016)

There is currently no cure

Tinnitus originates in the peripheral auditory system for most sufferers (Jastreboff 1988)

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WHY SOUND THERAPY?

As many as 90% or more tinnitus sufferers have comorbid hearing loss (Sanchez et al 2005; Mazurek et al 2010; Weisz et al 2006)

Amplification works to reduce tinnitus perception when the pitch falls in the hearing aid response range; particularly below 6kHz
(McNeill et al 2012; Schaette et al 2010)

WHY SOUND THERAPY?

50 patients fit with hearing aid
50 fit with noise generator
50 used no device/ counseling only

All three groups showed significant reduction of TSI scores and tinnitus loudness ratings

but the **NO DEVICE GROUP** showed a smaller effect

Folmer and Carroll (2006)

WHY SOUND THERAPY?

Sound therapy can be effective for hyperacusis

Exposure to continuous low-level broadband noise shown to improve objective measures of loudness hyperacusis (Dauman & Bouscau-Faure 2005)

Formby et al 2003: Uncommon use of sound therapy Exposure to a lower sound level than UCL (50 dB for example) and gradually increase exposure over time in 5-dB steps until 50 dB is tolerable

WHY SOUND THERAPY?

…Because we need to TRY something?

We’re good at ruling out serious pathology, but poor at treating the regular tinnitus problem

67% of patients in a UK study reported good investigation of tinnitus source but were not offered any treatment options (McFerran et al 2018)

RISK & BENEFITS OF SOUND THERAPY

BENEFITS SHOWN WITH SOUND THERAPY

Table 3. A Comparison of the Results of Various Studies and the Measures Used

Measures	Treatment	Before	After	Change in Score	% Change	Study
THI	Open-ear hearing aids	57.9	27.9 (12 mo)	30	51.81	Parazzini et al, 2011
	Hearing aids + fractal tones	58.71	42 (6 mo)	16.71	28.46	Sweetow and Sabes, 2010
	TRT (open-ear hearing aids)	51.82	25.18 (6.91 mo)	26.64	51.41	Del Bo et al, 2006
	TRT (hearing aid)	47%	20.5% (12 mo)	N/A	26.5	Herráiz et al, 2006
THQ	Hearing aid + counseling	59.2	37.4 (12 mo)	21.8	36.82	Searchfield et al, 2010
	Counseling alone	50.8	43.6 (12 mo)	7.2	14.17	
TRQ	Hearing aids + fractal tones	52.57	40.86 (6 mo)	11.71	22.28	Sweetow and Sabes, 2010
TSI	Hearing aids	38.2	29.6 (6 mo)	8.6	22.51	Folmer and Carroll, 2006
TQ	Hearing aids	29.73	24 (6 mo)	5.73	19.27	Schaette et al, 2010
BDI	Hearing aids	5.2	5.2 (6 mo)	0	0	Folmer and Carroll, 2006
VAS	Hearing aids	71.18	60.09 (6 mo)	11.09	15.58	Schaette et al, 2010
	TRT (hearing aid)	6.6	6.4 (12 mo)	0.2	3.03	Herráiz et al, 2006
	Hearing aids	7.5	6.3 (6 mo)	1.2	16	Folmer and Carroll, 2006

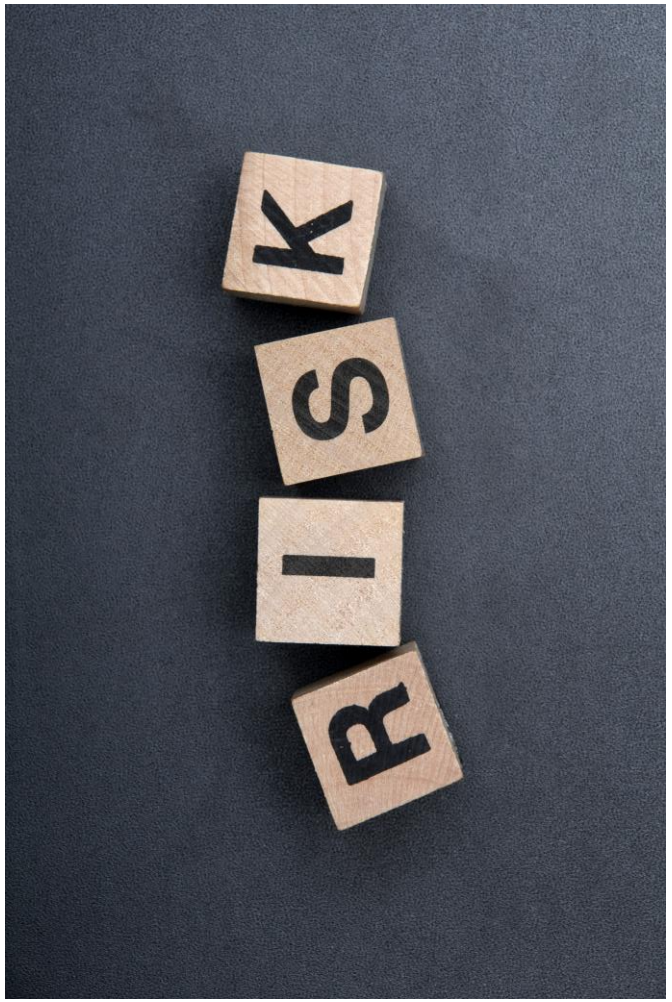
Shekhawat, Searchfield & Stineart 2013

THE RISK OF TRYING

If sound therapy is shown to help reduce the perceived volume or duration of daily tinnitus in some studies for some patients…

Is there any risk in trying it?

Cases to support there is a risk in ‘trying’ to help if the help is not done appropriately



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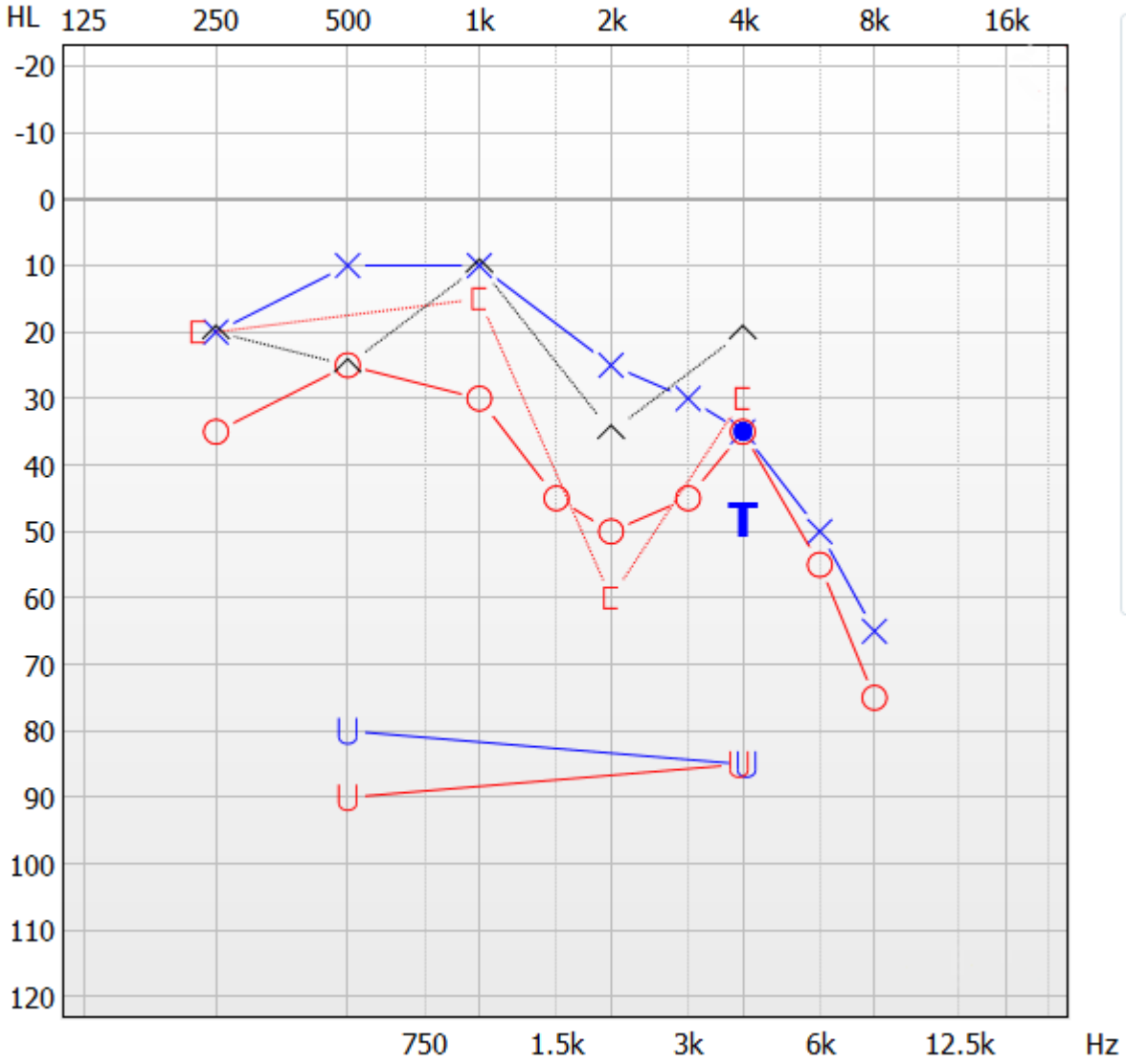
THE RISK OF TRYING | PATIENT CS



DELAYED MEDICAL CARE

- Fit at large retailer with bilateral amplification
- Amplification is a appropriate first course of action, BUT no attention paid to underlying medical source of tinnitus

Financial Implications?

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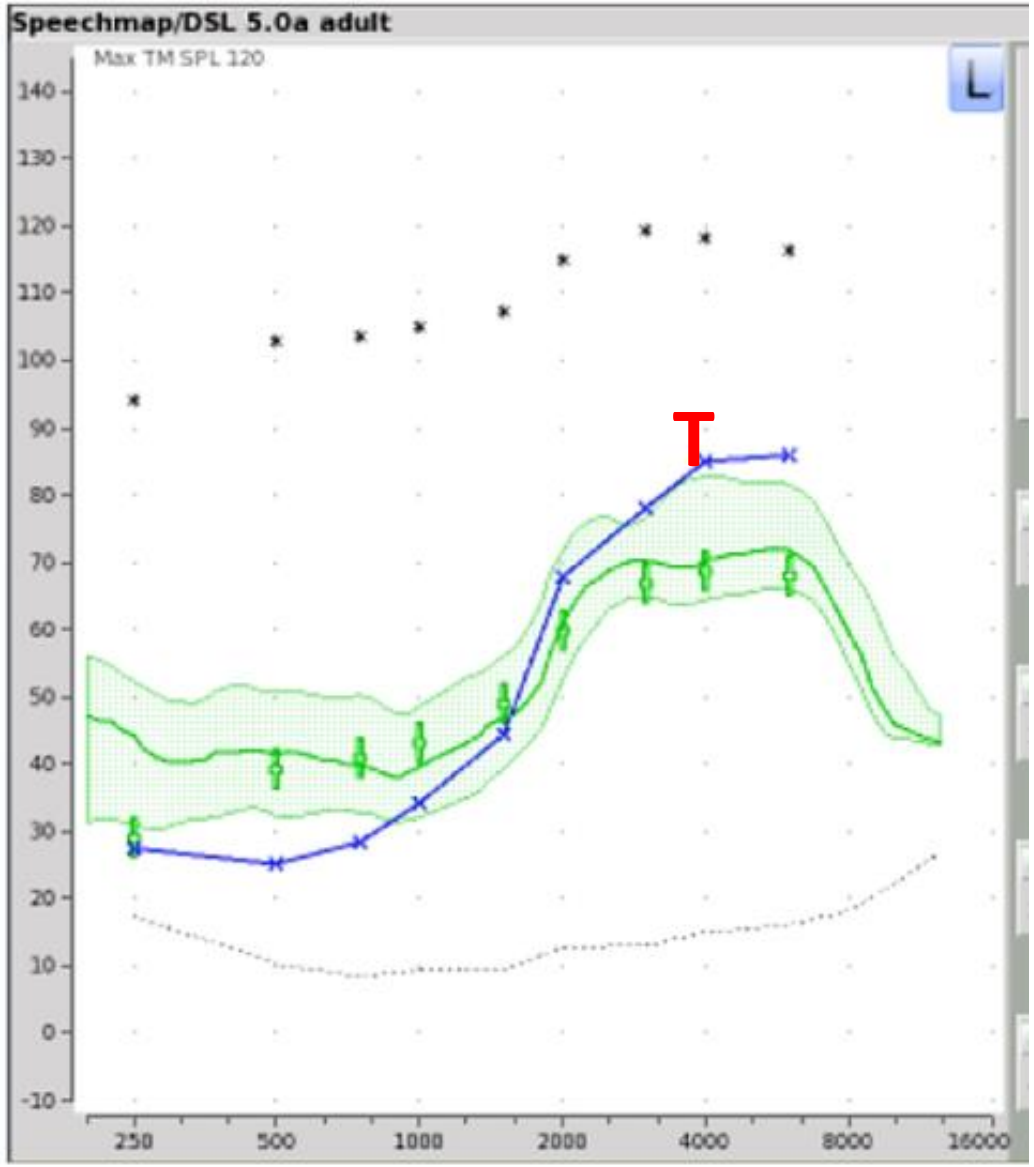
THE RISK OF TRYING | PATIENT TF



Don't fit tinnitus patients without On-Ear Measures

- Proprietary algorithm compared to DSL targets for 65 dB SPL in an open-fit configuration
- Audio-shaped TRT advised

Shetty & Pottackal (2019)

Best benefit for tinnitus when gain at tinnitus pitch increased until tinnitus is suppressed, beyond prescribed gain from NAL-NL2 or DSL v5

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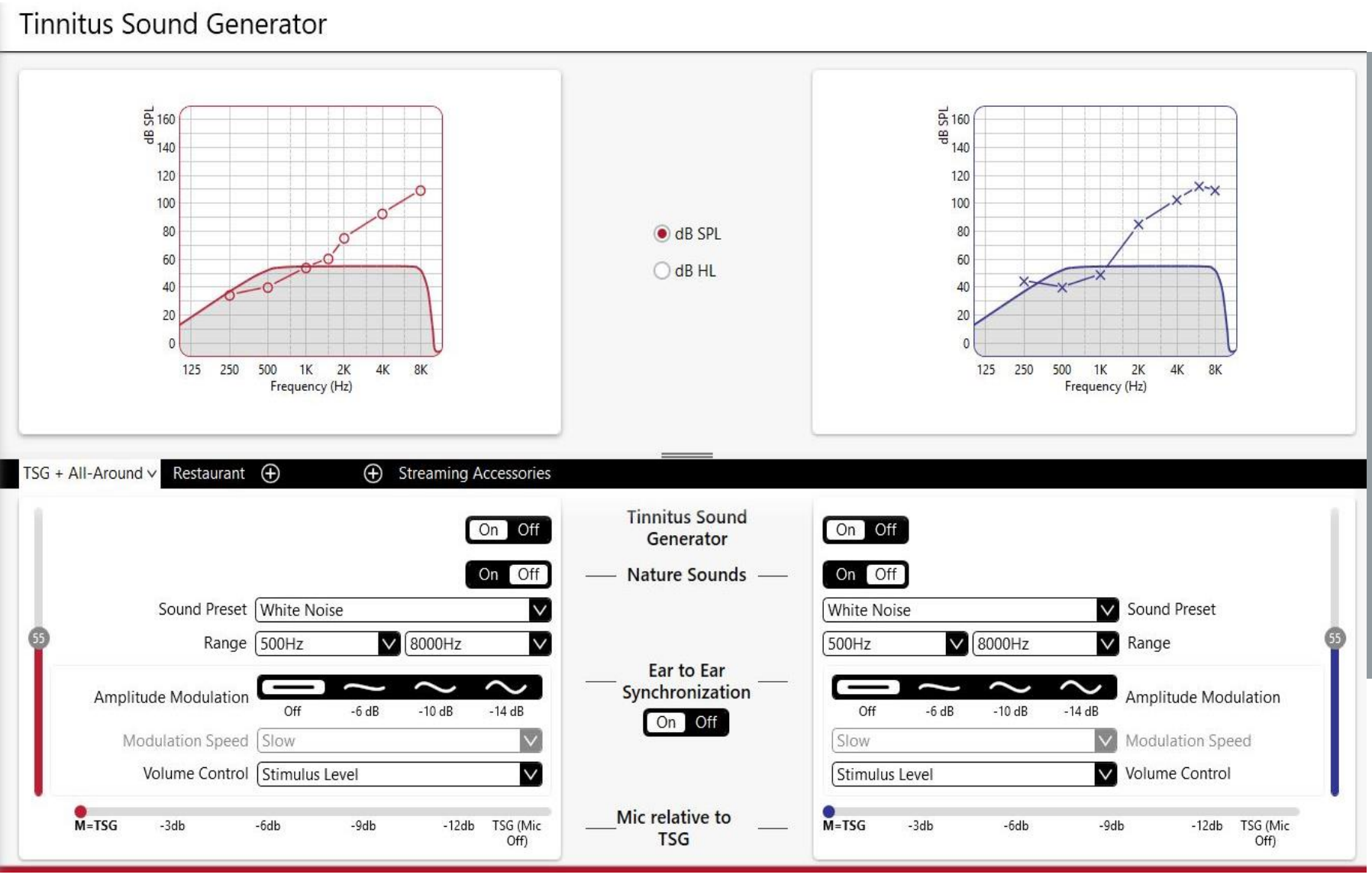
THE RISK OF TRYING | PATIENT RJ



INCREASED TINNITUS

- White noise for masking at 50 dBSPL without appropriate evaluation
- Increased tinnitus perception and distress over 4 month period

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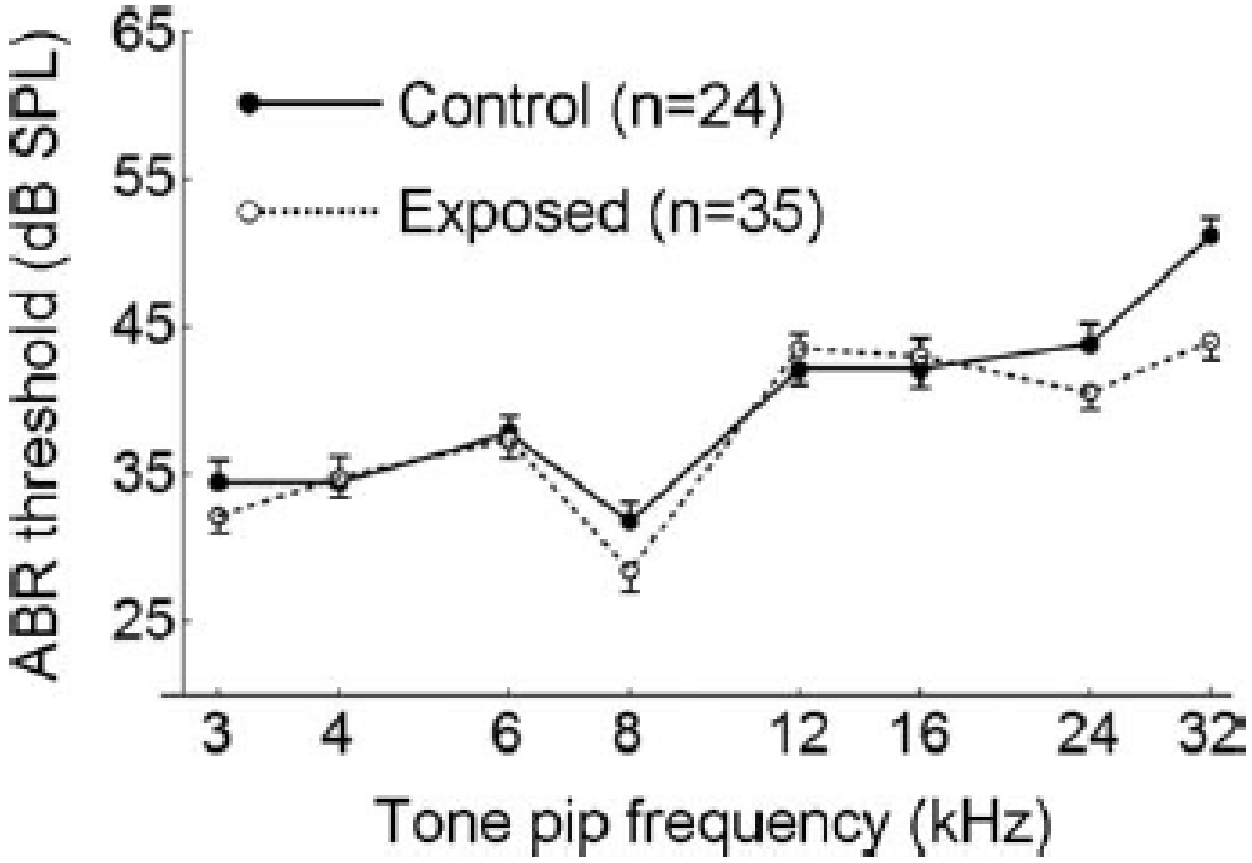
THE RISK OF TRYING | PATIENT RJ



Suppression in the primary and secondary auditory cortices was progressive, not unlike hearing loss restricted to a specific frequency range

(Pienkowski & Eggermont 2012; Irvine et al 2000; Pienkowski et al 2011)

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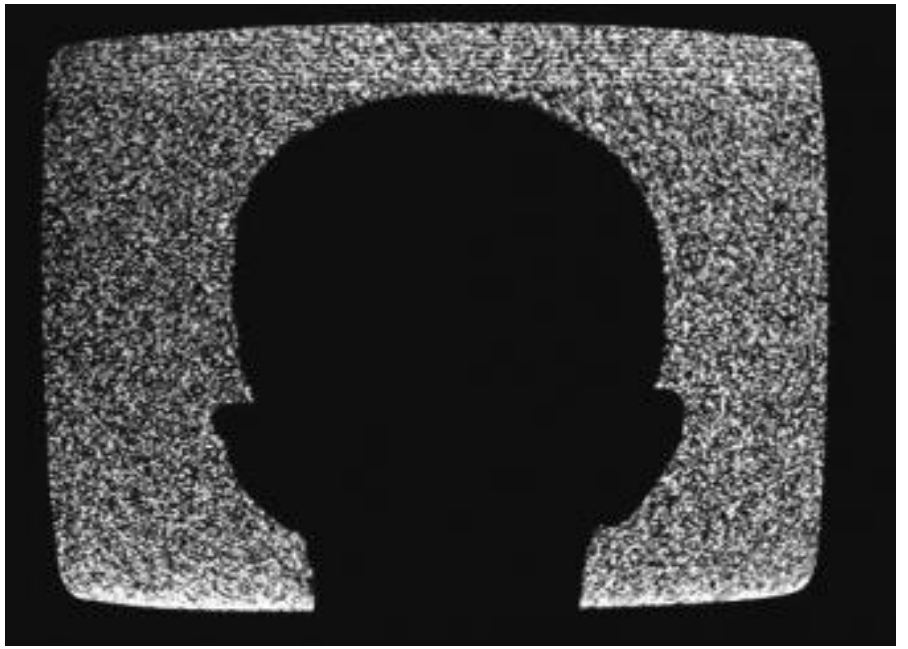
THE RISK OF TRYING | PATIENT RJ

Cats exposed to broad moderate noise (70 dB SPL) showed an increase in neural spontaneous firing, an increase in the synchrony of neural firing, and cortical tonotopic map reorganization…
without hearing loss



Is the same possible at lower dB SPL levels?

(Pienkowski & Eggermont 2012)

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THE RISK OF TRYING | PATIENT RJ

TAKE HOME MESSAGE

1. Long-term exposure to nontraumatic broadband noise (BBN) produces the same anatomical, physiological, and behavioral symptoms of hearing loss associated with tinnitus.

2. Concerning possibility that BBN exposure may be sufficient to unmask, exacerbate, or prolong tinnitus symptoms, even without damaging the cochlea.

Attarha et al 2018 Review

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DOES SOUND THERAPY EVEN WORK?

Sereda et al 2018 Cochrane Review:

No data to support sound therapy works over waiting list control, placebo, or education with no device

None of the studies measured depressive symptoms or depression, anxiety symptoms or generalized anxiety, or other important outcomes of interest in this review.

APPLICATION OF SOUND THERAPY

RECOMMENDED PROCESS

1. **Familiarize yourself with all available practice guidelines**
    1. ASHA Practice Portal (Coelho et al), AAA (Sweetow et al 2000), AAOHNS (Tunkel et al 2014), VA/DoD, UK Good Practice Guide (Hoare & Hall 2010), TRT Procedure (Jastreboff & Jastreboff, 2000)

2. **Read current Cochrane reviews**
    - Fernandez et al 2015 | Interventions for Tinnitus
    - Sereda et al 2018 | Sound Therapy
    - Phillips et al 2010 | TRT
    - Martinez-Devesa 2010 | CBT for Tinnitus

    - *and Fuller et al 2017 review of current guidelines

Guidelines Agree On….

1. Comprehensive Case History
2. Standardized Subjective Questionnaire
3. Standard audiometry & immitance
4. Loudness Discomfort Levels
5. Categorize patient: *Is this primary tinnitus or secondary from an underlying medical source needing referral?*

ASHA Practice Portal; AAA Guidelines; AAOHNS Guidelines

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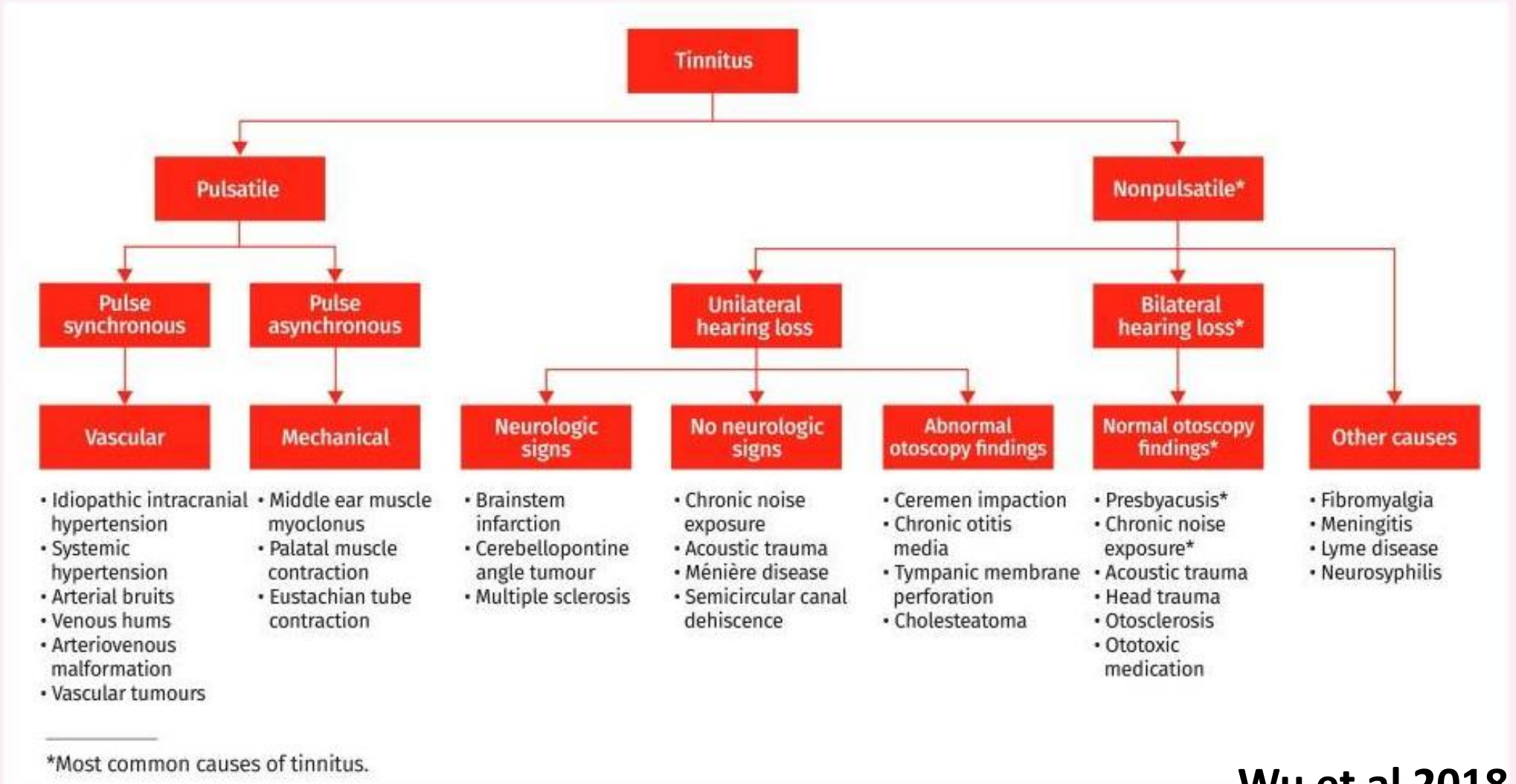
GOOD CASE HISTORY FOR DIFFERENTIAL DIAGNOSIS

Figure 1. Approach to the differential diagnosis of tinnitus symptoms



*Most common causes of tinnitus.

Wu et al 2018

CATEGORIZE YOUR PATIENT AND PROCEED ACCORDINGLY

TEMPORAL MANIFESTATIONS	CLINICAL IMPLICATIONS
1. **SPONTANEOUS** • Transient ear noise	Normal phenomenon
2. **TEMPORARY** • Associated with specific event 3. **OCCASIONAL** • Every few weeks/months	Educate about hearing conservation and monitor symptoms as appropriate
4. **INTERMITTENT** • Every day/week 5. **CONSTANT**	Audiological exam; brief tinnitus assessment; counsel regarding hearing conservation; tinnitus intervention if needed

FIGURE 3. Temporal manifestations of tinnitus (Henry et al, 2016).

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CATEGORIZE YOUR PATIENT AND PROCEED ACCORDINGLY

Table 1 Categories of Tinnitus and Hyperacusis Patients

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

Jastreboff & Jastreboff 2000

Guidelines Agree On….

5. Appropriate counseling regarding tinnitus

   *If appropriate amplification does not improve symptom…. or not needed

6. Tinnitus Psychoacoustic Evaluation (Pitch, Loudness, MML)
7. CBT has the most evidence… but (insert evidence-based treatment of choice here)

ASHA Practice Portal; AAA Guidelines; AAOHNS Guidelines

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When in Doubt…

If you want to deliver amplification and sound therapy for tinnitus, follow a published tinnitus management program

1. Progressive Tinnitus Management (PTM)
2. Tinnitus Activities Treatment (TAT)
3. Tinnitus Retraining Therapy (TRT)

Or test, amplify appropriately, then refer

AMPLIFICATION + SOUND THERAPY

TIPS AND APPLICATION

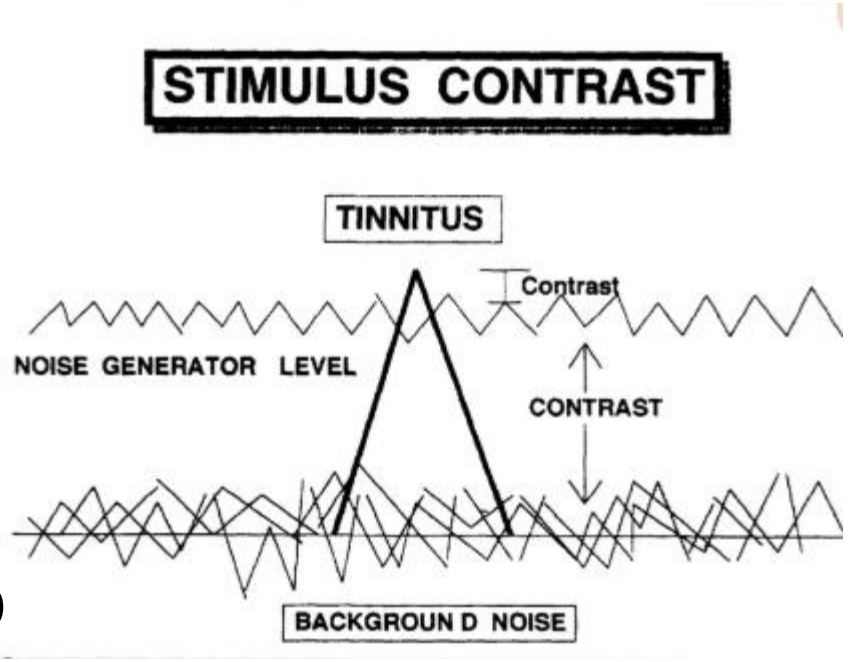
1. BILATERAL AMPLIFICATION

Del Bo 2007 suggests that the best clinical result for someone with tinnitus requires binaural amplification.

Trotter 2008 found no difference in tinnitus improvement between unilaterally and bilaterally aided patients.

Jastreboff 2000 reports anecdotal clinical evidence of tinnitus switching ears in unilateral cases

2. OPEN HEARING AID | SOUND TX FITTINGS



- **Open-fit coupling is recommended** (if acoustically appropriate)
- Allows natural environmental sound to enter the ear, as well as amplifying those sounds, improving perceived sound quality
- Reduces potential to enhance internal noise through occlusion

(Del Bo 2007; Forti 2010; Sandlin & Olsson 1999)

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3. AMPLIFICATION BANDWIDTH FOR TINNITUS

- **Masking effects are best when tinnitus pitch falls in frequency response of hearing aid**, per TRQ score.
  (McNeill et al. 2012; Folmer & Carroll, 2006; Schaette et al 2010)

Hearing loss dependent?

- Extending the bandwidth to include tinnitus > 4kHz did not result in a reducing in tinnitus (Moffat et al 2009)

- Extending the bandwidth past tinnitus pitch is recommended; especially in mild-moderate hearing losses where it might provide masking benefit

4. SOUND THERAPY FOR TINNITUS > 4KhZ

- To achieve masking and provide high-frequency stimulation, combination amplification + sound therapy should be offered to patients with high-pitched tinnitus and high-frequency hearing loss (above 4 kHz)

- Normal environmental sounds are usually limited to frequencies below 4 kHz

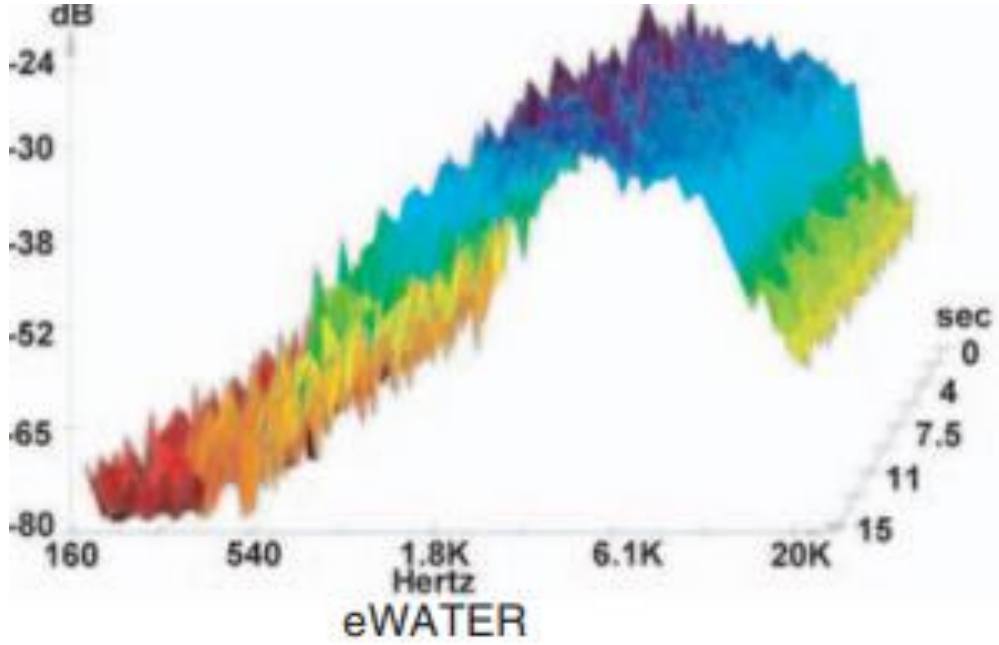
(Vernon and Meikle, 2000, 2003)

5. USE STRUCTURED SIGNALS

- **Replace broadband signals with structured signals** like filtered, modulating noise, music or speech (Pysanenko et al 2018; Shore et al 2016; Henry et al 2004)

- **Music filtered to match tinnitus percept**, altered/notched to exclude tinnitus is shown to suppress tinnitus-related hyperactivity (Davis et al. 2007, Neuromonics; Okamoto et al 2010)

- **Acoustic coordinated reset neuromodulation**, which randomly presents brief tones both above and below the pitch of the tinnitus to improve desynchronization and cortical map differentiation (Wegger et al 2017)



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6. SAFE SOUND THERAPY SETUP

- **Low-frequency noise bands may temporarily exacerbate tinnitus**
- 2kHz – 12kHz filtered noise is commonly used in the Oregon Tinnitus Clinic

- **Bilateral sound therapy** prevents development of abnormal central receptive fields or shifting of unilateral tinnitus to the non-treatment ear

- Sandline & Olsson 1999: 54% of patients (n=1664) reported a single tinnitus sound. **Using sound therapy that encompasses all sounds** increases effectiveness

- **Ears may need to be tested and fit separately** for maximum effect
  - Or one at a time depending on interaction effect of sounds in bilateral fit

Vernon & Meikle Ch 14, Jastreboff Ch 15, Tinnitus Handbook, 2000

General Rules of Sound Level

Normal hearing: Sound TX or hearing aid with Sound TX and amplification off
*or mild gain around tinnitus frequency if possible?

Hearing Loss with Thresholds < 70 dBHL: Amplification + Sound Tx

Hearing Loss with Thresholds > 70 dBHL: Amplification only

Constant noise > 60 dB SPL may lead to cortical change

Jastreboff & Jastreboff 1999; Jastreboff 2000; Pienkowski & Eggermont 2012

8. HABITUATION THERAPY AT THE MIXING POINT

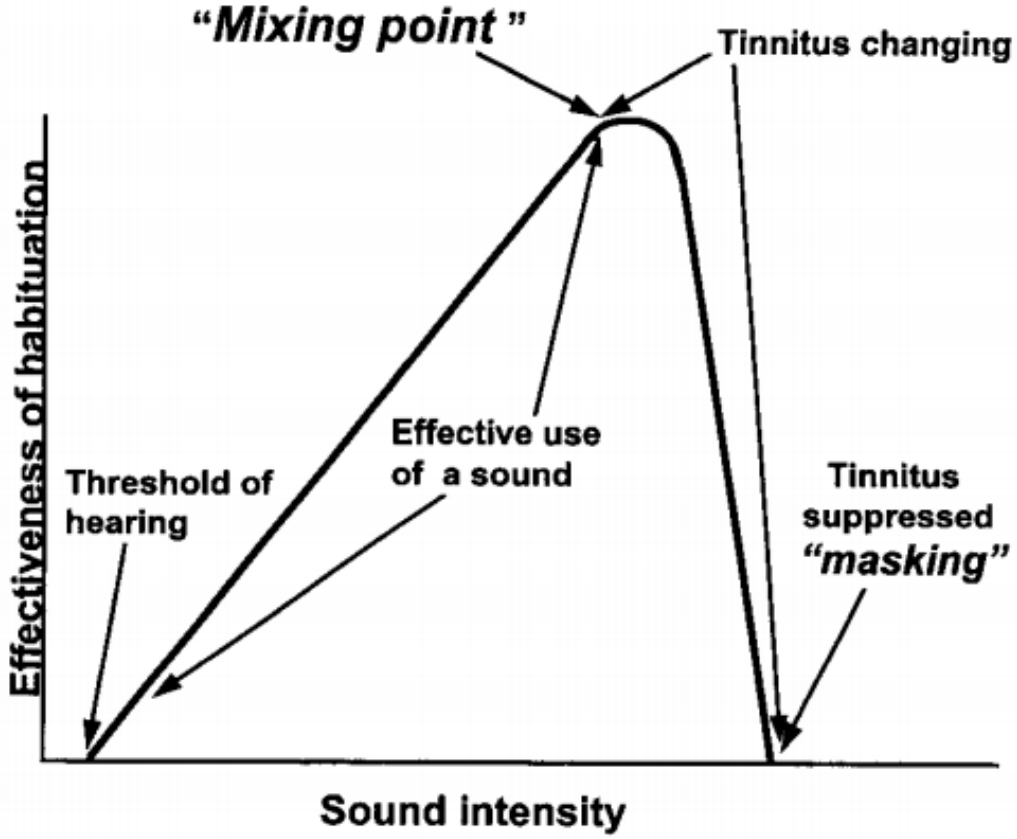

Figure 4 Theoretical dependence of the effectiveness of habituation on the intensity of the sound used for the sound therapy.

True TRT includes counseling and 'some' type of auditory enrichment

- This could include TV, radio, environmental sounds at mixing point
- Often it includes bilateral sound generators using narrowband (~ 2 octave) noise

Jastreboff & Jastreboff 2000

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9. PROPRIETARY PROGRAMS

LEVO SYSTEM

iPod + headphones

Proprietary Tone (pitch-matched, amplitude modulated tone) played at 50% of tinnitus level or lower (habituation method/not masking)

Customizable TX sounds for testing and treatment

Data logging that records patient usage

+ Used overnight

https://otoharmonics.com/

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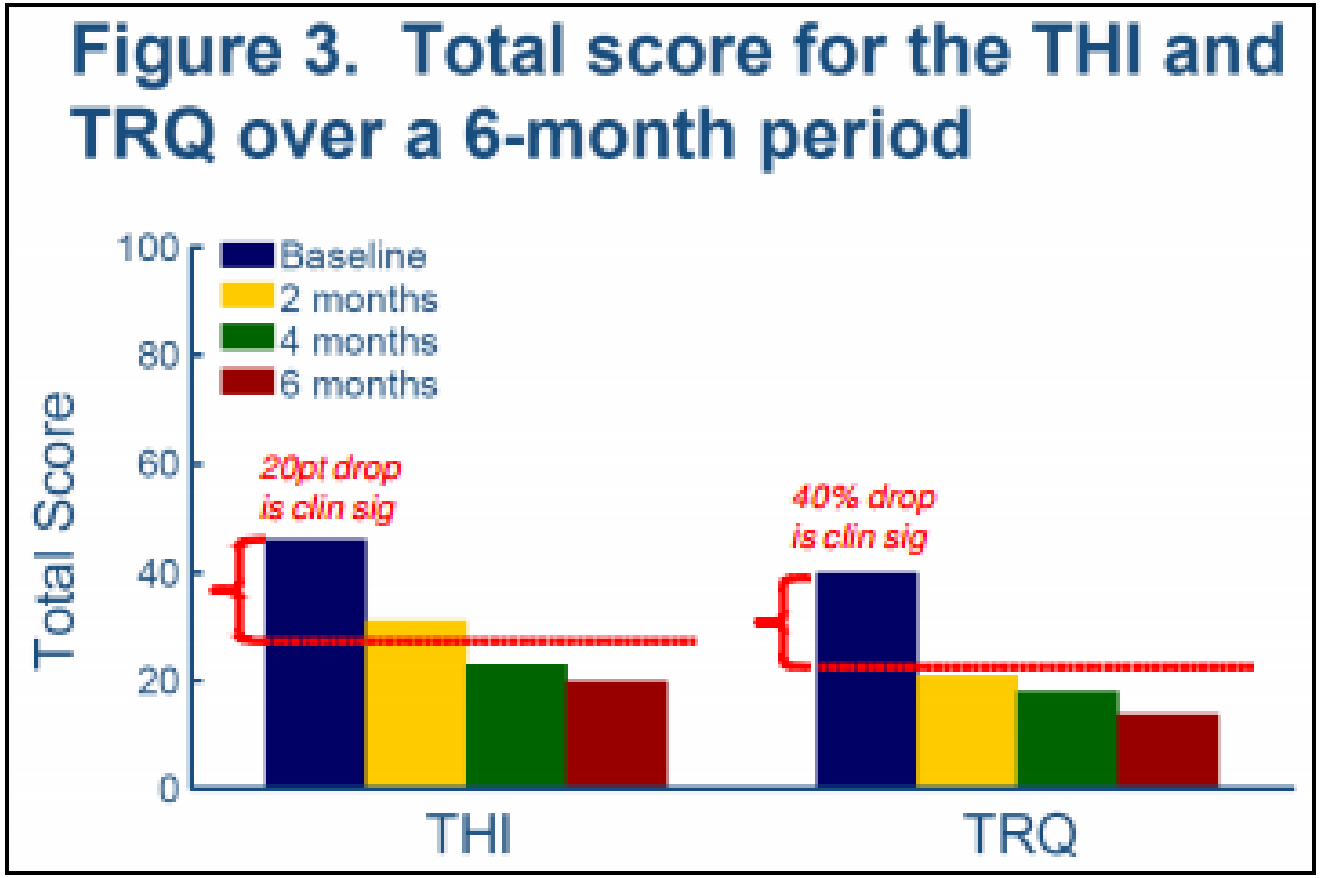
Neuromonics

- **Stage One: Symptom Relief**
  - 2 months
  - 2-4 hours/day
- **Stage Two: Break the Cycle**
  - 4 months
  - <2 hours/day with gradually declining use
- **Stage Three: Maintenance**
  - Use as needed 2-4 hours/week indefinitely

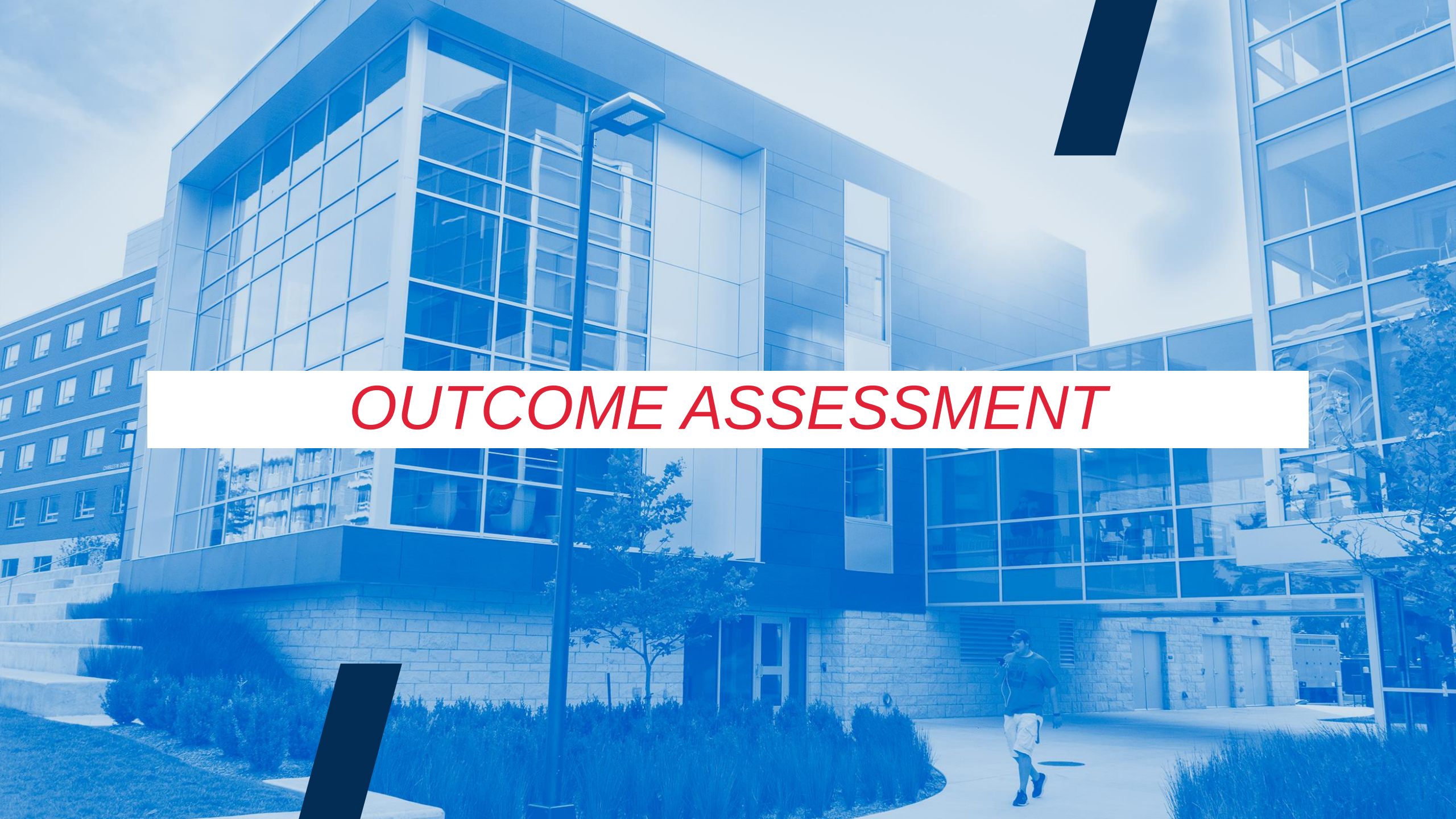


(Davis et al 2008)

Desyncra

- iPod + headphones
- Worn during waking hours
- Customizable TX sounds for testing and treatment
- Neuromodulation

https://www.desyncra.com/



OUTCOME ASSESSMENT

HOW CAN I TELL IF ITS WORKING?

- Pre & Post Subjective Questionnaire (30, 60, 90 days)
- Patient satisfaction surveys
  - Include patients who proceed with amplification only and amplification with sound therapy
- Redo UCLs

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Thank You!

Questions?

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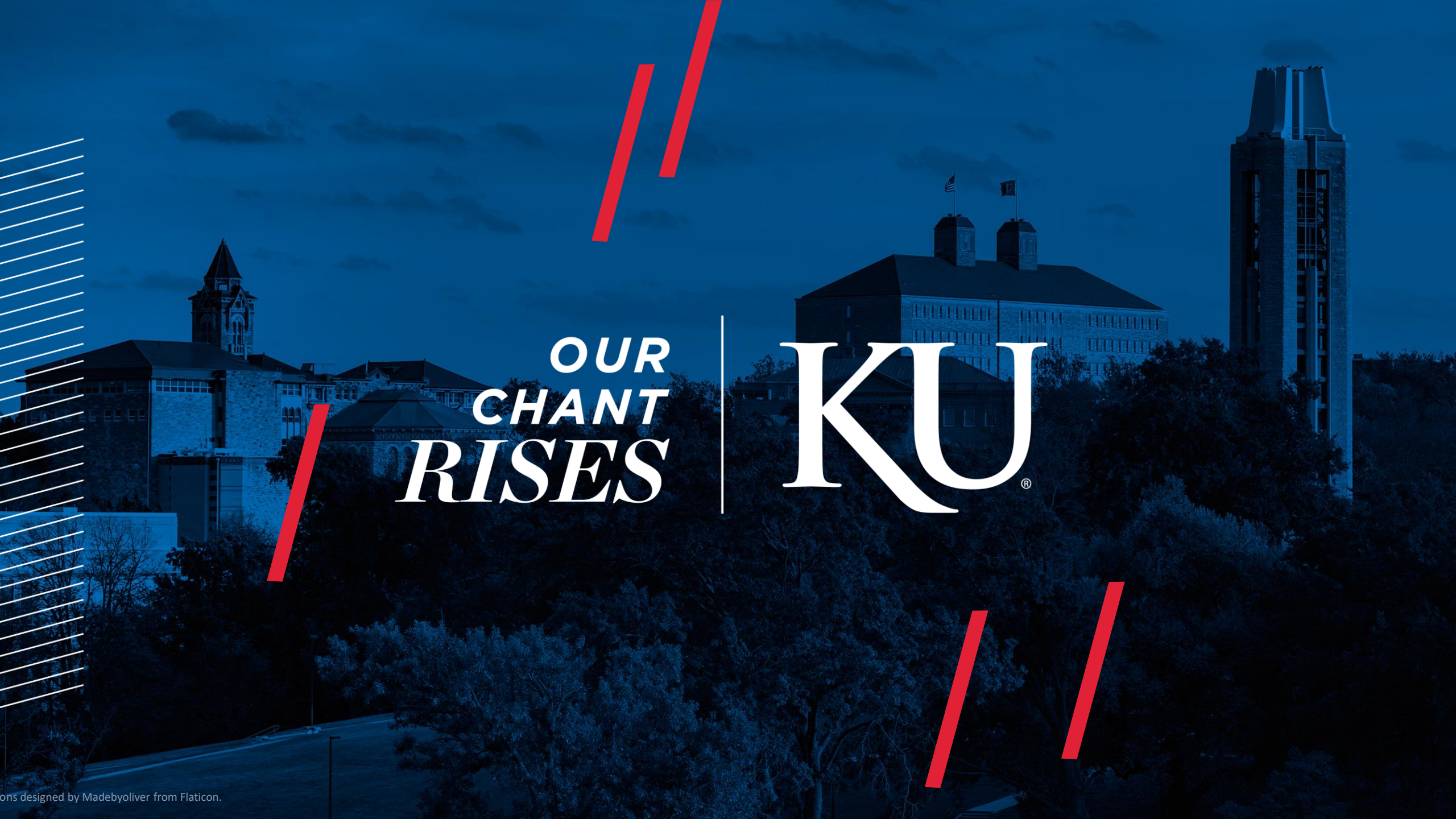

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