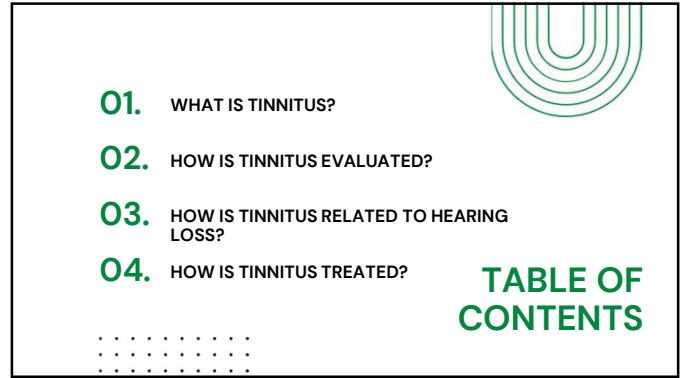


**HEARING LOSS AND TINNITUS:
INTERACTION AND MANAGEMENT**

UNT COLLEGE OF HEALTH & PUBLIC SERVICE
Department of Audiology & Speech-Language Pathology

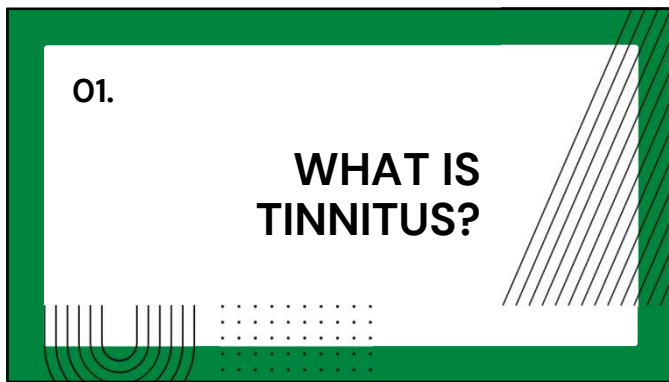
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01. WHAT IS TINNITUS?
02. HOW IS TINNITUS EVALUATED?
03. HOW IS TINNITUS RELATED TO HEARING LOSS?
04. HOW IS TINNITUS TREATED?

TABLE OF CONTENTS

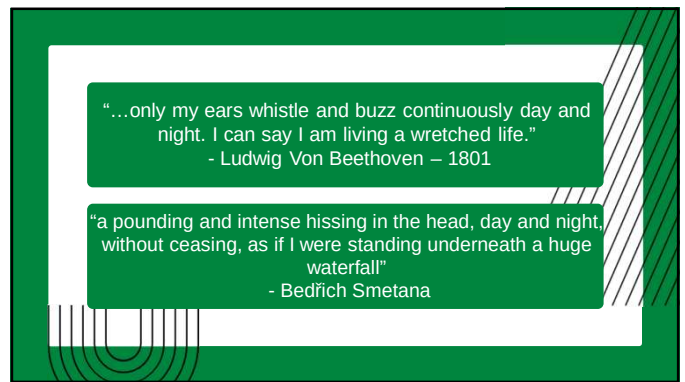
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01.

WHAT IS TINNITUS?

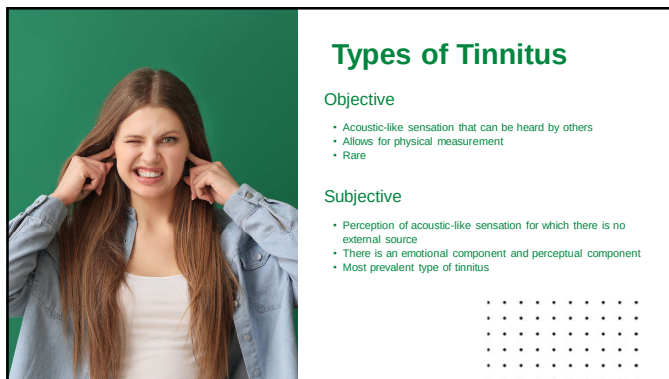
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"...only my ears whistle and buzz continuously day and night. I can say I am living a wretched life."
- Ludwig Von Beethoven – 1801

"a pounding and intense hissing in the head, day and night, without ceasing, as if I were standing underneath a huge waterfall"
- Bedřich Smetana

4



Types of Tinnitus

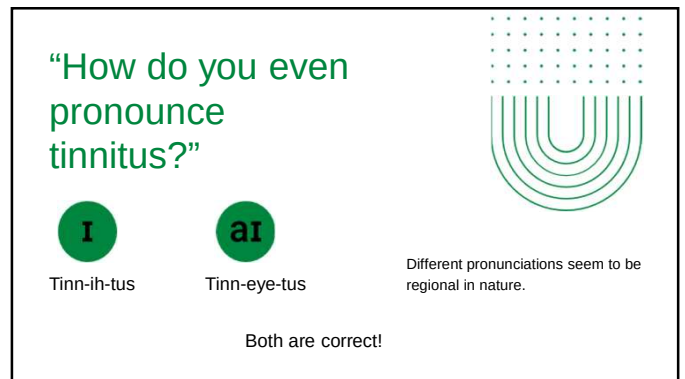
Objective

- Acoustic-like sensation that can be heard by others
- Allows for physical measurement
- Rare

Subjective

- Perception of acoustic-like sensation for which there is no external source
- There is an emotional component and perceptual component
- Most prevalent type of tinnitus

5



"How do you even pronounce tinnitus?"

i Tinn-ih-tus **ai** Tinn-eye-tus

Both are correct!

Different pronunciations seem to be regional in nature.

6

TINNITUS STATISTICS

A third of people ages 65-75 have tinnitus
That number increases to 50% after age 75

25 million people in the US report some level of tinnitus
5 million of those have severe tinnitus and 2-3 million have debilitating tinnitus

90% of tinnitus cases occur with underlying hearing loss
16 million people seek medical attention for tinnitus annually

7

Occupational Statistics

- ✓ Musicians are 57% more likely to have tinnitus than the general population
- ✓ Tinnitus ranks as the number one disability among returning military service members
- ✓ 22 million Americans are exposed to hazardous noise levels each year
- ✓ 1 in 13 Americans in the working population have tinnitus



8

Descriptors

<p>Subjective Tinnitus Most often described as "ringing" Can be any noise perceived without an external source</p>	<p>Objective Tinnitus "Thudding" sounds are commonly perceived Can be very intermittent</p>
<p>Auditory Hallucinations Sounds with information, like music or speech These are a subset of the tinnitus heading</p>	<p>Heartbeat Some people perceive a "heartbeat" sound This is a type of tinnitus known as "pulsatile"</p>

9

TINNITUS PATHOLOGY




10

MECHANISMS OF TINNITUS

Any ear disorder has the potential to cause tinnitus
There's no consensus on what exactly can cause tinnitus and no research is consistent on exact mechanisms.

There are known risk factors
Smoking, noise exposure, untreated cardiovascular issues are just some examples of risk factors for tinnitus.

Ototoxicity is a known factor
Drugs that are ototoxic (damaging to the ear) are known to cause tinnitus. These drugs include aminoglycosides, aspirin, loop diuretics, some chemotherapeutic drugs (cisplatin), and others.



11

Vibratory tinnitus

Middle Ear tumors

Abnormal Inner Ear Function

Abnormalities of auditory processing

Compression of the facial nerve

Abnormal firing in the nervous system

None of these are perfect and none of these have been proven to be true 100% of the time.

Tinnitus is a symptom, not a disorder in itself.


Proposed Causes

12

"PHANTOM LIMB PAIN"

Tinnitus is often compared to "phantom limb pain" - the sensation that occurs when there is perception of pain or discomfort in a limb that is no longer attached to the body.

Tinnitus is compared to it because it is a "phantom" sensation that often indicates damage or complete removal of a previously available physical sensation.



13

02. HOW IS TINNITUS EVALUATED?

14

Who evaluates tinnitus?

Audiologists	Ear Nose and Throat Physicians	Cognitive Behavioral Therapists
<p>Doctors of Audiology are the primary hearing care medical professionals who evaluate, diagnose, and sometimes manage tinnitus.</p> <p>There are some treatments that are not within the audiologist's scope of practice and may require a referral to another professional.</p>	<p>ENT physicians are M.D.s that specialize in disorders of the ear, nose, and throat.</p> <p>They often provide medical treatment if there's an underlying medical diagnosis for the tinnitus.</p>	<p>CBT professionals provide cognitive behavioral therapy to help with habituation and emotional reactions to tinnitus.</p> <p>There are some CBT specialists that specifically treat tinnitus or hearing disorders.</p>

15

STEPS OF A TINNITUS EVALUATION

<p>CASE HISTORY</p> <p>Specific questions about perception and timing of the tinnitus as well as occupation and hobbies</p> <p>Also will contain questionnaires for emotional status</p>	<p>COMPREHENSIVE HEARING EVALUATION</p> <p>Complete evaluation of auditory pathway and processing</p> <p>Determines if hearing loss is a factor</p>	<p>TINNITUS PERCEPTION MATCHING</p> <p>Matching of pitch and loudness level as perceived by the patient</p> <p>General matching ability</p>	<p>MASKING EVALUATION</p> <p>Testing for whether a masking sound for management is effective</p> <p>Masking sounds are commonly effective, but not for everyone</p>
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16

TINNITUS EVALUATED

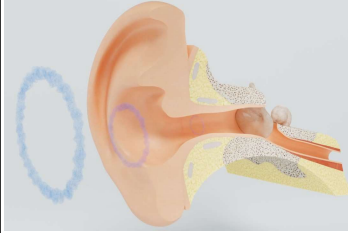
<p>PITCH MATCHING</p> <p>Comparison of pitches from low to high until the patient indicates one is the most similar to their tinnitus</p>	<p>LOUDNESS MATCHING</p> <p>Increase of sound until the patient indicates it is the approximate level of their tinnitus</p>	<p>MASKING LEVEL</p> <p>Determining via (usually) white noise if there is a level at which the tinnitus is masking by the noise</p>	<p>LOUDNESS DISCOMFORT</p> <p>Increase of sound until the patient indicates it is intolerable</p>
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17

03. HOW IS IT RELATED TO HEARING LOSS?

18

Summary of Auditory Process



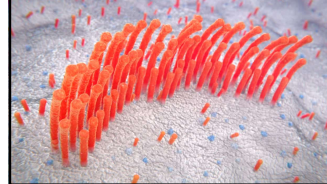
- 01 When sound enters the ear canal, it sets the eardrum into motion through the pressure from the sound waves.
- 02 The eardrum moves three ear bones (called ossicles) that push and pull along with the eardrum to create mechanical motion.
- 03 The motion of the last ossicle connected to the inner ear (called the cochlea) moves fluid inside the cochlea to stimulate tiny hair cells.
- 04 The hair cells stimulate different portions of the auditory nerve based on the pitch and loudness of each sound.
- 05 The auditory nerve transfers that information through the auditory pathway up to the brain where the sounds are interpreted.

19



Damage can occur at any stage of the auditory process.

The most common type of auditory damage is centered around the inner ear, particularly the hair cells and nerve function.

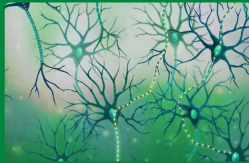


Over time, the hair cells degrade and begin to lose function. This means that the areas of sound that those hair cells are responsible for signaling are no longer being processed.

This leads to what is called "auditory deprivation".

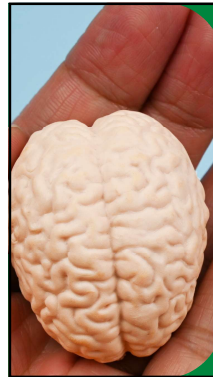
20

AUDITORY DEPRIVATION



- Hearing loss causes a lack of auditory stimulation in the brain
- This disrupts the flow of the neural pathways through the auditory system
- This activates neural plasticity in the brain and creates spontaneous activity
- Neural plasticity is the brain's ability to change and adapt based on experience

21



Neural Plasticity

While it is very useful in many situations, neural plasticity with tinnitus means that the brain is creating this phantom sound in an attempt to help compensate for lack of stimulation

In response to injury or damage (hearing loss), the neural plasticity system creates the "phantom limb pain" which is actually an unwanted change

Animal studies show significant changes in the processing when auditory deprivation is achieved that returns to normal when stimulation is brought back

22



This is why hearing aids can help with tinnitus alleviation: It is returning the auditory information to the brain


23

04.

HOW IS TINNITUS TREATED?

24

Unfortunately, there is no cure for tinnitus.



Because there is no one "cause" of tinnitus and many potential causes, there is nothing that a scientist or researcher can focus on for cure research.

There are options for management.

25

Tinnitus Management



- Low Severity Options**
General recommendations for those who do not have a severe level of handicap.
- Physical Options**
Management through physical treatments or devices.
- Psychological Options**
Management through psychological treatment, including habituation therapy.

26

General Recommendations

1	Avoid stimulants (coffee, lots of soda, salt, alcohol)
2	Cease smoking
3	Reduce stress levels
4	Appropriate sleep habits
5	Avoid medications that cause tinnitus that are not prescribed

27

Physical Management




- Drug Therapy**
There is no proven drug therapy that is effective, although some have been shown to be circumstantially effective.
One suggestion has been to use anxiety or depression medication to help with the emotional component.
No supplement or drug has been shown to be definitively effective.
- Masking Devices**
As stated before, hearing aids can be effective maskers on their own with no additional sounds.
If there is no hearing loss, using other sounds can help with masking: white noise, music, fans, etc.
It does not work for everyone, particularly those with catastrophic levels of tinnitus severity.

Biofeedback, like the Lenire system, has had very promising results but is still relatively new.

28

Tinnitus and Stress



Are tinnitus and stress related?
Yes. If stress increases, emotional reactions are more likely to be negatively heightened.

Limbic system is activated significantly.
The limbic system is what regulates the emotional aspect of tinnitus. When stress is high and tinnitus is perceived, the limbic system is triggered even further.

The negative reinforcement increases the tinnitus annoyance and length of time.
The more stress and negative perceptions occur, the more severe the tinnitus long term.

29

Psychological Management

Depression is more common in those with chronic tinnitus than those without.
The emotional component of tinnitus is strong and often one of the biggest factors in the impact to a patient's daily life.

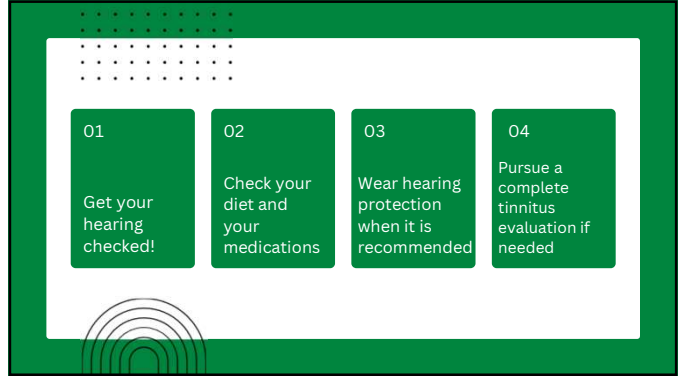
The purpose of psychological management is to have people use coping mechanisms to change their reactions or thoughts about their tinnitus.
Reducing or eliminating maladaptive or destructive thoughts and behaviors is the primary goal of this treatment. Trained therapists work with individuals individually on habituation and adaptation.

Cognitive behavioral therapy (CBT) is the most common recommendation.
There are psychological management options that audiologists can implement as well with patients who need a more audiologic based approach.

30



31



32

	<h3>Why hearing protection?</h3>
	<p>Noise exposure is one of the most common causes of tinnitus. Without protection, damage to the ears will occur much sooner than simply with age.</p> <p>Musicians, members of the military, those who work with heavy machinery, and those with hobbies such as hunting are all at high risk.</p> <p>Strategies to protect your hearing can include earplugs, over-the-ear headphones, limiting exposure to excessively loud sounds, reducing the loudness of music systems, and moving away from the source of the sounds if possible.</p> <p>This can help with early hearing loss and tinnitus prevention. Other ways to prevent it are avoiding smoking, keeping your body healthy, and asking your doctor if another medication is a good idea if it is ototoxic.</p>

33



34