

Thoughts and Emotions 1



- The overall plan in session 2 is to target Thoughts and Emotions.
- By providing basic information on hearing loss and tinnitus, the unknowns, misconceptions, and fears will often be alleviated.
- Later, the importance of hearing and attention will be discussed. We can divert our attention away from things that are unusual or surprising, such as tinnitus.





- Sound causes movement of air molecules
- Air molecule movement causes air pressure in ear canal to increase
- Air pressure in ear canal causes eardrum to vibrate
- 3 bones connected to eardrum also vibrate
- Bones connected to inner ear
- Inner ear made up of snail shaped cochlea
- Cochlea has hair cells and nerves which react to sound
- Cochlea is not something that can be removed from skull
- Cochlea is filled with fluid
- Vibration of ossicles causes fluid to move
- Movement of fluid causes hairs cells to move
- Hair cells send message to auditory nerves
- Auditory nerves deliver message to brain
- Brain interprets message as sound



- Can think of the cochlea as your hearing organ
- We have 2; one in each ear
- This organ is small!!!! Only approximately 30 mm.
- Cochlea is like a piano
- If you unroll the cochlea it represents a piano keyboard
- Piano keys make different pitched sounds
- Hair cells "play" different notes



- Inside cochlea are thousands of hair cells and nerves
- Inner and outer hair cells
- OHC amplify soft sounds
- IHC primary messengers to brain
- Both hair cells connected to auditory nerves



- Vibration of bones causes fluid in cochlea to move
- This causes tiny hairs on top of cell to move
- There is a chemical reaction between the hair cell and the nerves which causes the nerves to become active
- The nerve activity goes to brain
- Brain interprets nerve activity as sound
- · Loud sounds activate more nerves than soft sounds



- •Even when there is no sound, there is nerve activity
- •This nerve activity can be measured even when you don't know it is happening
- •This nerve activity is called random spontaneous activity
- •No specific pattern to activity
- •Ignored by brain thus not perceived as sound



- Here are three examples of how neural impulses convey information to the brain to be heard as sound.
- Line 1 In the absence of sound, there is random spontaneous activity on the nerve fibers
- Line 2 When a word is spoken such as *table*, a particular pattern of impulses is conveyed.
- Line 3 Other sounds such as that of a *cricket* create a unique pattern of activity.



• There are multiple different causes of tinnitus, such as age, noise induced hearing loss, head injury, medications and drugs, certain diseases, and unknown.



- Hearing loss is like having some of the keys missing on a piano
- Sounds with a certain pitch may not be heard, due to missing hair cells



- Normal hearing, have all/most of hair cells
- Hairs stand up straight
- With hearing loss, some of HCs are missing
- On other hairs cells, hairs no longer stand straight up, look like tornado went through

Nerve Activity			
Normal Hearing		Lots of information sent to the brain	
Hearing Loss		Limited information sent to the brain	
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- With normal hearing all the auditory nerves are sending information to the brain
- With a hearing loss, since some of the hair cells are missing or damaged, so some of the nerves don't receive their messages
- Also, some nerves can be damaged
- Thus, brain gets a smaller amount of information, or some information doesn't reach the brain
- This means if you don't hear a sound, it means the brain didn't get the information
- Or if you hear speech but can't understand what is being said, the brain received some information but not enough to be able to interpret it correctly



- Currently we can't replace damaged or missing hair cells
- Can use hearing aids, which make sounds louder, thus more nerves are activated to send message to brain
- But brain may not be able to interpret message even when more nerves activated, which is why may hear speech with hearing aid, but not necessarily understand what was said



ADD NOTES



- Review pt's audiogram
- Point out area of probable cochlear damage



- Discuss with the patient their hearing abilities and communication difficulties.
- Also discuss ways to improve their hearing abilities, through devices, hearing protection, etc.



- There are two main ways to tell sounds apart pitch and loudness.
- High pitch sounds vibrate at a higher frequency, and produce a shorter wave. Low pitch sounds vibrate at a lower frequency, and are seen by a longer wave.
- Soft sounds are heard at a lower intensity vs. loud sounds have a higher intensity, and bigger wave.



- What is tinnitus?
- It is a sound that is perceived within one or both ears, or in the head.
- The internal sound that people with tinnitus hear is different for each individual. Some hear ringing, buzzing, hissing, etc.



- Though tinnitus and hearing loss both result from damage to the hearing system, you do not have to have hearing loss to have tinnitus.
- Tinnitus does not damage hearing.
- Changes in hearing are not necessarily associated with changes in tinnitus.



- Same things that cause hearing loss, cause tinnitus
- However, hearing loss does not cause tinnitus and vice versa
- May have hearing loss but not have tinnitus
- May have tinnitus but no hearing loss



- Millions of Americans report tinnitus. Tinnitus tends to be reported higher in older populations and by those in noisier jobs and hobbies.
- Current figures from 2011-12 Survey from U.S. Center for Disease Control:
- 15% of Americans have tinnitus
- 1% report debilitating or troublesome tinnitus
- 30% of people over 60 have tinnitus



Currently there is no drug or surgical procedure that can cure tinnitus.

Though realistic expectations are important, there is hope for relief, as many patients find ways to cope with tinnitus by changing their reactions to tinnitus and how it affects them.



The auditory cortex is part of the temporal lobe in the brain, which codes the sounds we hear and speech.

Tinnitus is coded in the brain just like other sounds we hear and can be measured.

Tinnitus is an Increase in Spontaneous Nerve Activity			
Normal Hearing		Hear Silence	
Hearing Loss (No Tinnitus)		Hear Silence	
Tinnitus		Hear Sound	
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- Recall that neural impulses are what code the sounds we hear and transmit them to the brain.
- Line 1 In normal hearing, there is spontaneous nerve activity which we do not hear
- Line 2 In cases of hearing loss, this spontaneous activity decreases because not all nerve fibers transmit the impulses to the brain.
- Line 3 Tinnitus causes an increase in spontaneous activity and fills in more gaps. Instead of hearing silence, we hear the tinnitus sound.



- Tinnitus is different for different people. Here are examples of neural presentations of different tinnitus sounds.
- How would you describe the sound of your tinnitus?
- Consider the spontaneous activity of the nerves that change based on the sound you hear, vs. some other tinnitus sound.



- In this section, the two types of attention are discussed, as well as how our attention is captured.
- It is important to increasing attention in other areas in order to reduce attention to tinnitus. Doing this can provide relief.



- Our brain attends to stimuli in two ways:
- conscious attention, the level of awareness when we think about and analyze various stimuli
- Subconscious attention, when we monitor information, but do not consciously analyze it. However, a monitored item may move to conscious attention at any time if it grabs our attention.



- Stimuli from the five senses, touch, smell, taste, vision, and sound, compete for our attention
- All of these stimuli are coded in different areas of the brain.



- We can only consciously attend to one stimuli at a time. We receive many stimuli at a given time.
- All other stimuli will remain in our subconscious until it grabs our attention and moves to conscious attention, or is ignored.







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• Our attention is impacted by several things including our emotional state, important events, novelty or newness of a situation, and other factors



Consider the importance of the stimuli and how we respond to it.



There are several sounds that immediately will be attended to consciously, such as a police siren.


Things that capture our conscious attention are unusual, important, scary and unexpected

Tinnitus can be defined by all of these categories

No wonder tinnitus can be extremely noticeable at its onset or if it changes





• If there was lion in the room and I said it was my pet lion, he's very gentle, just ignore him

• You would have very difficult time ignoring him

• This is because the subconscious creates a list of things for us to be aware of in order of importance

• We focus on one thing at a time

• We have some control over what we pay attention to but our control is limited in cases of things in our environment that are associated with something negative or dangerous.

• If the stimulus has a strong negative connotation we lose our control over monitoring this signal altogether and automatically our attention focuses on this specific stimulus

• This is a good thing: Our body (subconscious) needs to warn us (conscious) when we are in danger



•Some background sounds initially grab our attention, but we automatically habituate to them

•If the signal is evaluated as neutral and does not carry significant info (e.g. refrigerator noise), a repetitive presentation of the same sound will not activate the amygdala and autonomic nervous system. It will not attract our attention and we will not be aware of its presence. The signal is habituated.





- Neutral sounds that do not carry any significant information will be ignored
- Important sounds such as an alarm, a lion roar, etc. that carry with them an emotional reaction, will not be ignored
- Some sounds will be monitored automatically and not attended to consciously





The ways in which our brain attend to sounds is complex. First, all sound is coded by the cochlea, and sent up to the brainstem for further coding.

Our brainstem then monitors signals at a subconscious level. The information is sent to the cerebrum or our brain.

The cerebrum or brain is what consciously attends to signals, by hearing and interpreting sound and speech.

Our cerebrum is connected to the amygdala, the limbic system, and our autonomic nervous system, which aid in formation of memory and our emotional reactions to sounds.



- Reassure the patient that tinnitus does not make a person deaf, senile or imply a state of mental illness
- If these thoughts predominate one's thoughts, it is easy to become preoccupied with them

If the brain decides tinnitus is not important

- Not attend to it
- Becomes less noticeable/bothersome
- Can take some time (several months)
- For some people it may occur quickly
- For other people it will take longer

• Our brain will determine if a signal is important, which in turn dictates how we react to it.

- If our brain decides tinnitus is not important, several things could happen:
 - We will no longer attend to tinnitus
 - We will habituate to tinnitus
- This process takes a long time, often several months for most individuals.
- For some people, this may happen more quickly, but it may take longer for some.

Activities

- Describe an image you like (e.g. a new car) and one you don't like (e.g. a snake)
- Describe a sound you like (e.g. music) and one you don't like (e.g. a siren)
- Describe your tinnitus

PART 4: CHANGE THE EMOTIONAL REACTION TO TINNITUS



- We have many thoughts throughout the day and night, not every thought is important.
- Our thoughts generally fall into 3 categories:
 - Neutral
 - Negative
 - Positive
- This will give rise typically to three different categories of emotions:
 - Neutral
 - Negative
 - Positive



- The brain can "learn" a response to a sound
- The brain can also learn different response to same sound
- The brain automatically attaches an emotional reaction to doorbell depending on the consequence
- Same sound produces opposite reactions of the body depending on the context and the interpretation of what is going on.
- In a similar fashion exactly the same sound of tinnitus might produce an entirely different reaction depending on the context.



Goal:

- 1) help identify specific underlying thoughts about tinnitus,
- 2) determine if these thoughts are positive, negative or neutral
- 3) If negative, help learn how to neutralize them



•Try to identify thoughts, beliefs, attitudes and perception in response to tinnitus (have a discussion with pt about these)

- •What does/did pt believe the tinnitus was?
- •Did they think the tinnitus was harmful to them?
- •What goes on in their mind when they hear their tinnitus?





•When engaging in negative thoughts, encourage the patient to challenge these thoughts.

•Examples:

•I hate this noise!

•This is a negative thought that will elicit negative emotions (anger, frustration)

•I can't live the rest of my life with this noise in my head!

•This is also a negative thought that will lead to negative emotions such as worry, anxiety, and hopelessness

•Recommend that they engage in constructive thoughts and help them feel the physiological/emotional difference.

•Examples

- •"This is okay"
- Less emotionally charged

How to Change Our Reaction to Tinnitus

- 1. Change Interpretation of Importance
- 2. Change Emotional Reaction
- 3. Refocus on Other Activities
- 4. Reduce Contrast Between Background Sound and Tinnitus



- Tinnitus is likely the result of increased spontaneous nerve activity
- Many people have tinnitus you are not alone
- Tinnitus is not threatening your health or hearing
- Tinnitus and **YOUR REACTION** to tinnitus are two different things

- Change your interpretation of the importance of tinnitus by recognizing several important facts:
 - Tinnitus is likely the result of increased neural activity
 - Tinnitus is common, affects 15% of adults
 - Tinnitus is not threatening your health or hearing
 - Having tinnitus and your reaction to tinnitus are 2 different things.
 - You can change your reaction to it by first decreasing its importance



By decreasing the attention with give to tinnitus, this can help you to be less bothered by it.



- Consider the 2 types of attention subconscious and conscious attention
- Brain monitors background sounds all the time—this is normal
- We pay attention to important, strange, fearful sounds (
- Sounds we interpret as important (siren, baby cry) will be monitored more closely
- If tinnitus is not important, it is less likely you will pay attention to it



• You can change your emotional reaction through a conscious effort

• When you can hear your tinnitus and not react with annoyance, etc. brain will learn to ignore it





- Discuss the reasons for activities that patient is involved in.
- Encourage them that activities need some intrinsic value
- We are not looking for activities to "get away" from tinnitus or to hear the tinnitus less
- We are looking for activities that are simply pleasurable

 Reduce the Contrast Between Tinnitus and Background Sounds

Low level noise makes tinnitus more difficult to detect	
Tinnitus	
Low Level Noise	
Tinnitus in Low Level Noise	Thoughts and Emotions 62

• In quiet, the tinnitus signal is enhanced and the brain has nothing else to distract it from "hearing" the tinnitus

• If put low-volume noise in environment, it becomes harder for the brain to keep track of or detect the tinnitus

• The low volume sound is used to interfere with the detection of the tinnitus related neural activity

• We are consciously aware of only a small portion of incoming sounds because these sounds are filtered out before they reach the level of conscious perception.

• As your emotional reaction to the tinnitus is reduced, the brain will interpret the tinnitus the same way it does other insignificant background noise and filter it out.



- Small candle in dark room = very noticeable
- Similar to tinnitus in a quiet room
- Put candle in front of brightly lit window and it is not as noticeable
- Similar to tinnitus with low volume noise



The background sound can partially mask the unwanted sound we hear.

Here, a barking dog is the unwanted sound, and the fan is the background sound that helps minimize the barking dog sound



Sounds from a fan, a TV, or a stereo are all ways to add a low level background sound in the environment.

A great exercise is to have the tinnitus patient take some time to "sound search"; search for sound(s) that mix well with the tinnitus making the tinnitus less noticeable.



Listening to recorded material, such as CDs, nature sounds, and music can help provide background sound



Using a sound generator that plays white noise or other static or modulated sounds may be helpful.



- Do any sounds make the tinnitus less noticeable?
- Common sounds that might mask tinnitus are Rain, Wind, Music, and Stream.
- Encourage patient that they are not looking for a sound for the tinnitus to go away, but a neutral sound that might make it less noticeable.





Use the techniques discussed earlier to help improve the patient's reactions to their tinnitus:

- 1) Change the interpretation of the importance of tinnitus and emotional connection by *focusing attention on tinnitus, then on something else*
- 2) Refocus on new activities, by first *identifying alternative activities you enjoy*
- 3) Reduce the contrast between tinnitus and background sounds by *trying different low-level background sounds*.
 - This is often trial and error for each patient to determine the type of sound (white noise, ocean waves, rain, etc) and also the best volume level of sound. Great homework assignment.
 - We suggest the lowest volume possible that is helpful for tinnitus.



Patients often benefit from a specific assignment to work on to assist them in changing how they cope with tinnitus.

Therefore, a diary for the first weeks of treatment can be helpful.

Example Tinnitus Diary

- 1. Write down your thoughts and worries about tinnitus
 - My tinnitus will get worse over time.
- 2. Check to see if these thoughts match what actually happens
 - Though some days can be worse, my tinnitus is about the same.
- 3. List the alternative ways of thinking about tinnitus that you find helpful
 - I have tinnitus, but it is really a small part of my life.
- 4. We will discuss your thoughts at your next visit.

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1. Work to change the specific negative thoughts by consciously neutralizing them using self-talk.

2. You could consider making cue cards or sticky notes to visualize very neutral thoughts.

3. Say these thoughts either out loud or quietly to yourself. At first you will just be saying these words and not believing them. With time, you will believe your own words.

- Patient example:
 - Initial negative thought: "I don't want it"
 - Subsequent neutral thoughts:
 - "I have it"
 - "It's here and it's okay"
 - "It's going to stay and that's okay"
 - "It's okay if it comes and goes"
 - Positive thought:
 - "I'm going to allow it to be here"


- Encourage patient to list as many things that affect their tinnitus (for better or worse), enjoyable activities and sounds, and new activities or sounds they have tried.
- This will provide helpful information to discuss with the patient how to change their reaction to tinnitus, how to modify the environment, and what sounds could be added to decrease the prominence of their tinnitus.



We recommend that the diary be used for only a few weeks because we want the patient to move away from thinking about their tinnitus.

Example Tinnitus Diary – Week 1

• Make changes in your daily life so you are doing more activities where your tinnitus is better and fewer activities where your tinnitus is worse. List the new activities and how your tinnitus was affected.

Activity

Effect on Tinnitus

- Day 1: Walking
- Day 1: Heard birds chirping, did not notice tinnitus

• Day 2:

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- Day 2:
- Day 3:

Day 4:

- Day 3:
- Day 4:
- Day 5: Day 5:
- Day 6:
- Day 7:
- Day 7:

Day 6:

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Example Tinnitus Diary – Week 2

<u>Activity</u>

• Day 1: Gardening

Effect on Tinnitus

- Day 1: Focused on yard work, tinnitus less noticeable
- Day 2:
- Day 3:
- Day 4:
- Day 5:
- Day 6:
- Day 7:

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- Day 2:
- Day 3:
- Day 4:
- Day 5:
- Day 6:
- Day 7:



- After two weeks, you may stop journaling
- The intent is NOT to think of your tinnitus, but to find other activities you can engage in that take your mind off tinnitus.
- YOU can then make changes in your daily life so you are doing more activities where tinnitus is better and fewer activities where tinnitus is worse.

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