1 out of every 5 adults has hearing loss. That’s more than 48 million people in the US alone!

35% of US adults 40 and older have/had vestibular dysfunction. That’s over 69 million Americans!

Hearing loss and dizziness affects our quality of life and sense of independence!

1. Sound waves are picked up by the outer ear, which is made up of the pinna and the ear canal.
2. Sound is channeled to the eardrum, which vibrates when the sound waves touch it. The vibrations are picked up by three tiny bones known as the “hammer,” “anvil” and “stirrup,” which create a bridge from the ear drum to the inner ear.

3. The vibrations move on to the cochlea – a spiral-shaped capsule housing a system of liquid-filled tubes.

4. When the sound waves reach the liquid it begins to move, setting thousands of tiny hair cells in motion.

5. The movements of the hair cells are transformed into electric impulses that travel along the auditory nerve to the brain itself.

VESTIBULAR SYSTEM

- 3 Semicircular Canals
  - Rotation (horizontal), lateral flexion (lateral), and nodding (posterior)
  - Active movement of the head

- Otolith Organs
  - Utricle = horizontal
  - Saccule = Vertical
  - Position of the head when not in motion
Balance is dependent on many factors including sensory input from:

- Ears
- Eyes
- Sensory Systems

THE EAR IS JUST THE BEGINNING...

THE COMPREHENSIVE ASSESSMENT

- Physical Ear Examination
- Tympanometry & Acoustic Reflexes
- Audiogram
  - Speech and pure tones
- Additional Tests
  - Otoacoustic emissions
  - Auditory brainstem response
  - Imaging

TYPE, DEGREE, & CONFIGURATION
Evaluating the Auditory System

PHYSICAL EAR EXAMINATION (OUTER EAR)

TYMPANOMETRY / ACOUSTIC REFLEXES

Middle Ear Function:
- Transfer of acoustic sound waves, via mechanical vibration, to the fluid waves of the inner ear;
- Eustachian tube's ability to equalize air pressure on each side of the ear drum;
- Protection of the inner ear in response to loud sounds
Speech Reception Threshold (in quiet)
- The patient is oriented to standardized 2-syllable words at an audible level. The same words are then reduced in loudness until they cannot be repeated by the patient.
- Assesses threshold of speech awareness and may be a predictor of auditory nerve and temporal lobe involvement in hearing disorder

Speech Discrimination (in quiet)
- Random phonetically-balanced words are delivered at a calculated decibel level based on SRT.
- May be a predictor of working memory and temporal lobe auditory center recall.
- Scored as a percent

Frequency-Specific Pure-tones
- Air & Bone Conduction = outer vs. middle vs. inner ear disorder
- Predicts threshold of sound awareness across the speech spectrum

Pitch: Frequencies from 250 Hz to 8000 Hz

Type of Hearing Loss
- Conductive hearing loss
- Sensorineural hearing loss

Most hearing loss

Configuration = Shape

Sloping

Flat

Rising

Degree of Hearing Loss

Otoacoustic emissions = cochlear outer hair cell function
Auditory Brainstem Response = Auditory nerve & brainstem
Imaging
- MRI
- CT
- MRA

Additional Testing
DISORDERS OF THE AUDITORY SYSTEM

HEARING DISORDERS

Congenital
- Genetics
- Malformations
- In-Utero Infections

Acquired
- Malformations
- Obstructions
- Infections
- Injury / Trauma
- Growths / Tumors
- Noise-exposure
- Ototoxicity
- Age-related

DISORDER: MALFORMATIONS / SKIN CONDITIONS

DISORDER: OBSTRUCTIONS

DISORDER: INFECTIONS

DISORDER: TRAUMA / INJURY
DISORDER: PRESBYCUSIS / AGE

A NOTE ABOUT TINNITUS

- Affects 1 in 5 people;
  - Can sound like hissing, roaring, pulsing, whooshing, chirping, whistling, or clicking;
- About 10%–15% of adults have prolonged tinnitus requiring medical evaluation.
- 93% of tinnitus is caused by hearing loss of some degree!

A NOTE ABOUT WAX

- It’s GOOD!
- NO, it’s “NOT JUST WAX”
- Yes, it can cause a decrease in hearing, but that is why...
  - A hearing healthcare professional will and should ALWAYS rule out wax impaction
  - NO Q-TIPS ALLOWED!

WHY CAN I STILL “HEAR” IF I HAVE A HEARING DISORDER?

HEARING VS. PROCESSING

- Hearing isn’t just about volume, it’s:
  - Localization
  - Spatial Orientation/Balance
  - Timing cues
  - Language development
  - Short term → Long term memory exchange

REMEMBER...
DEMENTIA

 THERE IS NO PROVEN DIRECT RELATIONSHIP...
• Anyone who says, “if you don’t treat your hearing loss, you’ll get dementia” is false!
• However, evidence argues that hearing loss certainly doesn’t help!
  • …“risk of developing dementia was 2, 3, and 5 times higher in those with mild, moderate, and severe hearing loss…”
  • “There is strong evidence that hearing impairment contributes to the progression of cognitive dysfunction in older adults…”

Source: Better Hearing Institute

HEARING LOSS VS. DEMENTIA

Alzheimer’s
• Depression/anxiety/disorientation
• Reduced language comprehension
• Impaired short-term memory
• Inappropriate psychosocial response
• Loss of recognition (agnosia)
• Denial/defensiveness/negativity
• Distrust, suspicious of other’s motives

Source: Chartrand et al. 2015

Untreated Hearing Loss
• Depression/anxiety/social isolation
• Reduced speech comprehension
• Reduced cognitive input into memory
• Inappropriate psychosocial response
• Cognitive dysfunction
• Denial/defensiveness/negativity
• Distrust, feel that others are talking about them