PERIYAR MANIAMMAI INSTITUTE OF SCIENCE & TECHNOLOGY

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HUMAN ASSIST DEVICES

HEARING AIDS

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5. HEARING AIDS

1. Types of Deafness

1. **Conductive Hearing Loss:**

   This type of hearing loss occurs when there is an issue with the outer or middle ear that interferes with sound transmission to the inner ear.

   It is often caused by earwax, ear infections or problems with the ear canal or eardrum.

2. **Sensorineural Hearing Loss:**

   Sensorineural hearing loss is typically due to damage to the inner ear (cochlea) or the auditory nerve.

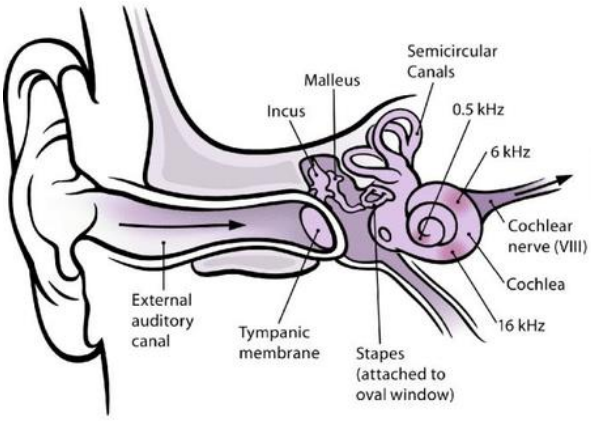
   It is often permanent and can result from aging, noise exposure, genetics or certain medical conditions.

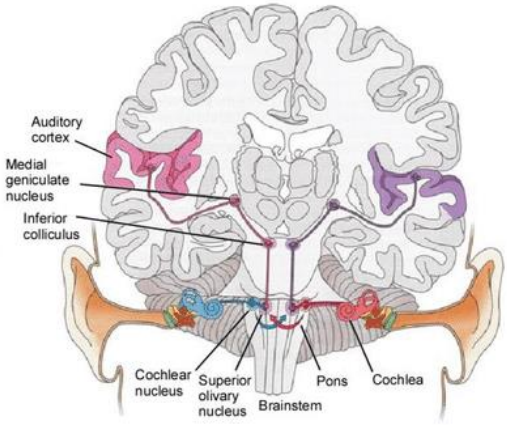
3. **Mixed Hearing Loss:**

   Mixed hearing loss combines elements of both conductive and sensorineural hearing loss, meaning there may be problems in both the middle ear and the inner ear or auditory nerve.

4. **Central Hearing Loss:**

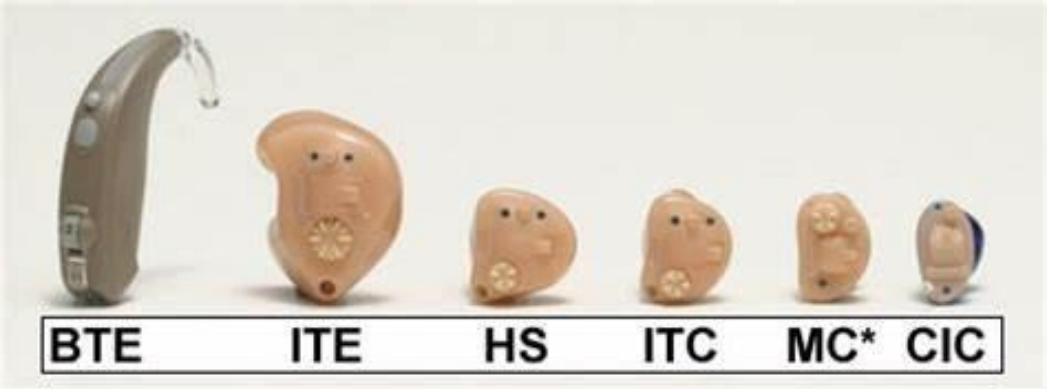
   This type of hearing loss is related to problems in the central nervous system, particularly the brain's ability to process sound. It can result from neurological conditions or brain injuries.



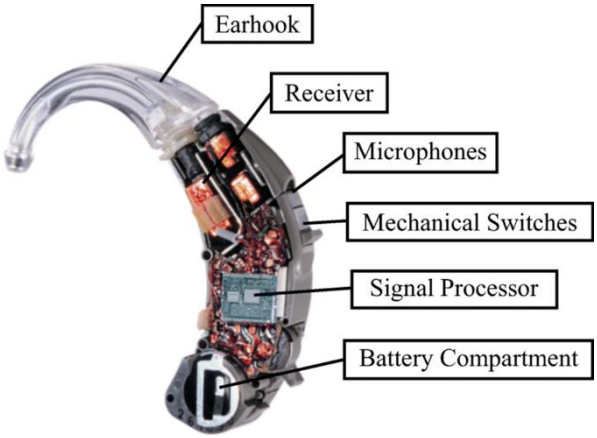


2. Types of Hearing Aids:

1. **Behind-the-Ear (BTE):** These devices rest behind or on top of the ear and are suitable for various types of hearing loss. They can accommodate larger batteries and offer various features.
2. **In-the-Ear (ITE):** Custom-molded to fit inside the ear, ITE hearing aids are less visible but may have fewer features due to their smaller size.
3. **In-the-Canal (ITC) and Completely-in-the-Canal (CIC):** These are among the smallest and most discreet hearing aids, fitting partly or entirely inside the ear canal.
4. **Receiver-in-Canal (RIC) or Receiver-in-the-Ear (RITE):** These models have a receiver (speaker) in the ear canal and connect to the main unit behind the ear via a wire.



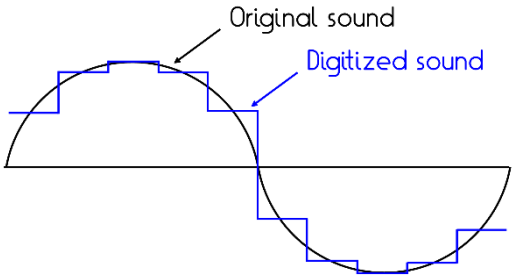
2.1. Components of Hearing Aids:



- **Microphone:** Collects sound from the environment.
- **Amplifier:** Increases the volume of collected sounds.
- **Receiver (or speaker):** Converts the amplified signals into sound and directs it into the ear canal.
- **Battery:** Provides power to the hearing aid.
- **Volume Control:** Allows the wearer to adjust the volume.
- **Program Button:** Permits users to switch between different listening modes or programs.

2.2. Digital vs. Analog Hearing Aids:

- Digital hearing aids are the most common type today, offering more precise sound processing and customization.
- Analog hearing aids amplify all sounds uniformly and are less flexible in terms of customization.



2.3. Features of Modern Hearing Aids:

- **Directional Microphones:** Focus on sounds in front of the wearer while reducing background noise.
- **Noise Reduction:** Helps filter out background noise for clearer speech.
- **Feedback Cancellation:** Minimizes whistling or feedback sounds.
- **Bluetooth Connectivity:** Allows hearing aids to connect wirelessly to smartphones and other devices.
- **Rechargeable Batteries:** Some models have built-in rechargeable batteries for convenience.
- **Telecoil:** Enables compatibility with hearing loop systems in public places.

2.4. Benefits of Hearing Aids:

- Improved hearing and speech understanding.
- Enhanced quality of life, social interactions and emotional well-being.
- Increased independence and safety.

2.5. Fitting and Adjustment:

- Hearing aids are custom-fitted by an audiologist or hearing care professional.
- The wearer may need multiple adjustment appointments to optimize settings and comfort.

2.6. Maintenance:

- Hearing aids require regular cleaning and maintenance to ensure their effectiveness.
- Batteries need replacement periodically or rechargeable models need recharging.

2.7. Compatibility with Hearing Loss:

- Hearing aids are suitable for various degrees and types of hearing loss, but not all hearing issues can be addressed with them.

2.8. Cost and Insurance:

- Hearing aids vary in price, and insurance coverage may not always be comprehensive.
- Financial assistance and subsidies may be available in some regions.

2.9. Consultation with a Hearing Specialist: -

Individuals experiencing hearing difficulties should seek advice from an audiologist or hearing care professional to determine the most appropriate solution.

Hearing aids have significantly improved over the years, offering better sound quality, comfort and customization options to meet the unique needs of individuals with hearing loss.

It's essential to consult with a healthcare provider to assess your hearing and explore the most suitable hearing aid options if necessary.

3. Speech Intelligibility Index (SISI):

SISI is a test used to assess speech perception in individuals with hearing loss. It measures a person's ability to understand and identify words or sentences at different levels of loudness. The test can help determine the optimal hearing aid settings for improved speech recognition.

4. Masking Techniques:

Masking techniques involve introducing background noise to a hearing test or hearing aid fitting. This helps audiologists assess how well a person can hear and understand speech in challenging, noisy environments. Masking can also be used in hearing aid programming to suppress tinnitus (ringing in the ears) and improve comfort in noisy situations.

5. Wearable Devices for Hearing Correction:

1. **Personal Sound Amplification Products (PSAPs):** These are devices that amplify sounds for individuals with mild hearing loss or those who need assistance in specific situations, like watching TV or attending meetings.
2. **Cochlear Implants:** Cochlear implants are surgically implanted devices that can provide hearing to individuals with severe to profound sensorineural hearing loss. They bypass damaged hair cells in the inner ear and stimulate the auditory nerve directly.
3. **Bone Conduction Devices:** These devices are suitable for people with conductive or mixed hearing loss. They transmit sound vibrations through the bones of the skull to the inner ear.
4. **Assistive Listening Devices (ALDs):** ALDs include devices like FM systems, captioned telephones and loop systems. They work in conjunction with hearing aids or cochlear implants to enhance sound clarity in specific situations.
5. **Smart Hearing Aids:** Many modern hearing aids are equipped with Bluetooth connectivity, allowing users to connect wirelessly to smartphones, tablets and other devices. They can stream audio directly to the hearing aids, control settings via mobile apps, and even make adjustments based on the wearer's preferences and environment.

These devices and techniques are valuable tools in managing different types of hearing loss and improving the quality of life for individuals with hearing difficulties.

It's essential to consult with a hearing healthcare professional to determine the most suitable solution for individual needs.

MCQ Questions:

1. Which type of hearing loss is often caused by issues with the outer or middle ear, such as earwax or ear infections?

A) Sensorineural hearing loss
B) Conductive hearing loss
C) Mixed hearing loss
D) Central hearing loss

2. What is the primary function of a cochlear implant?

A) Amplify sounds in the ear canal
B) Bypass damaged hair cells in the inner ear
C) Enhance speech perception in noisy environments
D) Provide relief from tinnitus

3. What is the Speech Intelligibility Index (SISI) used for?

A) To measure the loudness of speech
B) To assess speech perception in noisy environments
C) To evaluate the impact of hearing aids on tinnitus
D) To detect ear infections

4. Which type of hearing aid is custom-molded to fit inside the ear and is less visible when worn?

A) Behind-the-Ear (BTE)
B) Receiver-in-Canal (RIC)
C) In-the-Ear (ITE)
D) Completely-in-the-Canal (CIC)

5. What is the purpose of masking techniques in audiology?

A) To suppress tinnitus
B) To make sounds louder
C) To eliminate background noise in daily life
D) To test hearing in a soundproof booth

6. Which wearable device can be helpful for individuals with mild hearing loss or those who need assistance in specific situations like watching TV?

A) Cochlear implant
B) Bone conduction device
C) Personal Sound Amplification Product (PSAP)
D) Assistive Listening Device (ALD)

7. What do Cochlear Implants bypass to provide hearing for individuals with severe to profound sensorineural hearing loss?

A) Outer ear
B) Middle ear
C) Inner ear
D) Auditory nerve

8. Which type of hearing loss combines elements of both conductive and sensorineural hearing loss?

A) Central hearing loss
B) Mixed hearing loss
C) Sensorineural hearing loss
D) Noise-induced hearing loss

9. What is the primary purpose of assistive listening devices (ALDs)?

A) To amplify sounds in the ear canal
B) To provide relief from tinnitus
C) To enhance sound clarity in specific situations
D) To measure speech perception

10. Which type of hearing aid can connect wirelessly to smartphones and other devices and stream audio directly to the hearing aids?

A) In-the-Canal (ITC)
B) Behind-the-Ear (BTE)
C) Receiver-in-Canal (RIC)
D) Smart Hearing Aids

11. What is the primary purpose of a hearing aid?

A) To make the wearer's ears look more prominent.
B) To eliminate all background noise.
C) To improve the wearer's hearing.
D) To make the wearer's voice louder.

12. Which type of hearing aid is custom-molded to fit inside the ear canal, making it less visible?

A) Behind-the-Ear (BTE)
B) In-the-Ear (ITE)
C) Receiver-in-Canal (RIC)
D) Personal Sound Amplification Product (PSAP)

13. What is the main component of a hearing aid responsible for amplifying sound?

A) Microphone B) Receiver C) Battery D) Volume control

14. Which type of hearing loss is typically permanent and caused by damage to the inner ear or auditory nerve?

A) Conductive hearing loss
B) Central hearing loss
C) Sensorineural hearing loss
D) Mixed hearing loss

15. What do Cochlear Implants bypass to provide hearing for individuals with severe to profound sensorineural hearing loss?

A) Outer ear B) Middle ear C) Inner ear D) Auditory nerve

16. What is the purpose of Speech Intelligibility Index (SISI) testing?

A) To measure the loudness of speech
B) To assess speech perception in noisy environments
C) To evaluate the impact of hearing aids on tinnitus
D) To detect ear infections

17. Which wearable device is suitable for individuals with mild hearing loss or specific situational hearing needs, such as watching TV?

A) Cochlear implant
B) Bone conduction device
C) Personal Sound Amplification Product (PSAP)
D) Assistive Listening Device (ALD)

18. What is the primary purpose of assistive listening devices (ALDs)?

A) To amplify sounds in the ear canal
B) To provide relief from tinnitus
C) To enhance sound clarity in specific situations
D) To measure speech perception

19. Which type of hearing aid connects wirelessly to smartphones and other devices, allowing direct audio streaming and control via mobile apps?

A) In-the-Canal (ITC)
B) Behind-the-Ear (BTE)
C) Receiver-in-Canal (RIC)
D) Smart Hearing Aids

20. What is the primary purpose of the microphone in a hearing aid?

A) To control volume
B) To transmit sound to the battery
C) To amplify sounds
D) To collect sounds from the environment

Questions and Answers:

1. What is conductive hearing loss?

Conductive hearing loss is a type of hearing impairment caused by issues in the outer or middle ear, such as earwax blockage or ear infections.

2. What is sensorineural hearing loss?

Sensorineural hearing loss results from damage to the inner ear or auditory nerve and is often permanent. It can be caused by factors like aging and noise exposure.

3. What is mixed hearing loss?

Mixed hearing loss is a combination of both conductive and sensorineural hearing loss, involving problems in both the middle and inner ear.

4. What is the primary purpose of a hearing aid?

The primary purpose of a hearing aid is to improve the wearer's ability to hear and understand sounds.

5. Which type of hearing aid is custom-molded to fit inside the ear canal?

In-the-Ear (ITE) hearing aids are custom-molded to fit inside the ear canal, making them less visible.

6. What component of a hearing aid is responsible for collecting sounds from the environment?

The microphone in a hearing aid collects sounds from the environment.

7. What is the purpose of Speech Intelligibility Index (SISI) testing?

SISI testing assesses a person's ability to understand and identify speech in noisy environments, helping determine optimal hearing aid settings.

8. Why are masking techniques used in audiology?

Masking techniques are used to introduce background noise during hearing tests, aiding in the assessment of how well a person can hear and understand speech in noisy conditions.

9. What is the purpose of Personal Sound Amplification Products (PSAPs)?

PSAPs are wearable devices designed to amplify sounds for individuals with mild hearing loss or specific situational needs, such as watching TV.

10. What is the primary function of Cochlear Implants?

Cochlear implants are surgically implanted devices that bypass damaged hair cells in the inner ear and directly stimulate the auditory nerve to provide hearing for individuals with severe to profound sensorineural hearing loss.

MCQ Answers:

1.B) Conductive hearing loss

2.B) Bypass damaged hair cells in the inner ear

3.B) To assess speech perception in noisy environments

4.C) In-the-Ear (ITE)

5.A) To suppress tinnitus

6.C) Personal Sound Amplification Product (PSAP)

7.C) Inner ear

8.B) Mixed hearing loss

9.C) To enhan.ce sound clarity in specific situations

10.D) Smart Hearing Aids

11.C) To improve the wearer's hearing.

12.B) In-the-Ear (ITE)

13.A) Microphone

14.C) Sensorineural hearing loss

15.C) Inner ear

16. B) To assess speech perception in noisy environments

17. C) Personal Sound Amplification Product (PSAP)

18. C) To enhance sound clarity in specific situations

19. D) Smart Hearing Aids

20. D) To collect sounds from the environment