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Asking the right questions is truly the most effective first step in potentially finding an answer to the challenges of a hearing loss through cochlear implantation. These and many other good questions invariably come up:

- Who is considered a candidate?
- Where does the process start?
- What factors determine whether one can get a cochlear implant?
- How do you prepare for the appointments that determine candidacy?

What is a Cochlear Implant?

A cochlear implant is a system of digital technologies that combines information processing with an implantable, electrified device. This system provides an opportunity of better hearing sensitivity for patients who cannot use traditional amplification to successfully participate in the hearing world.

The cochlear implant system consists of two components:
- The internal device (receiver/stimulator with electrode array) which is surgically implanted.
- An external portion composed of a speech processor, headpiece and power source.

The external speech processor is a small micro-computer which may be either an ear level or a body-worn unit. The speech processor uses either rechargeable or disposable batteries for power. The headpiece portion consists of a transmitter and sometimes a microphone.

How Does a Cochlear Implant Make You Hear?

Sounds in the environment are picked up by the microphone and information is sent to the speech processor. The speech processor then codes the sounds based on characteristics of the sound. Which characteristics of the sounds are most important to speech understanding varies among individuals. Thus, the characteristics that are most important in an individual case are “mapped” into the system by the audiologist. The coded information is then sent by a cable to the transmitter portion of the headset.

The internal device receives the information and uses the information to form an electrical stimulus that is picked up by the nerve fibers of the inner ear. The brain receives this electrical stimulus much like it would sounds encoded into the auditory nerve of a hearing individual and processes the information within the hearing stations along an intricate pathway. The result is the perception of sound (Figure 1).

This “sound” may or may not be meaningful to the patient at first. Therefore, learning to use the electrical information may take time and possibly therapy to improve listening skills. Our team likes to refer to cochlear implantation as a process and not a procedure.

It is important to understand that the cochlear implant is not a cure for deafness. Rather, it is a tool to assist patients in achieving their goal for improved listening and communication abilities.

Who is a Cochlear Implant Candidate?

In general, adults with a 70 dB or greater sensorineural hearing loss bilaterally and who can only understand up to 50 percent of words in sentences with appropriately fitted hearing aids are considered candidates. Medicare uses criteria that are a bit more stringent based on presently available research data in seniors.

Medicare beneficiaries must have less than 40 percent understanding of words in sentences with appropriately fitted hearing aids. Other insurance companies may also have their own criteria for implantation so it is important to contact your insurance company to inquire about coverage for cochlear implantation.
While the above numbers serve as guidelines for clinicians and patients, perhaps a more important guideline to be considered is "Am I really communicating with others to my fullest potential with the use of my hearing aids?"

A cochlear implant candidate should have a desire to improve communication abilities and be motivated for the long-term. The cochlear implant process requires a lifetime commitment to managing the use of this sophisticated technology and using it to its fullest potential.

**How Do I Get Started?**
The first thing that should be done is to obtain a basic hearing test performed by your regular audiologist. This should be complete with air and bone conduction. Speech discrimination scores for both ears should also be a part of this evaluation.

During the appointment, let the audiologist know that you are interested in learning more about cochlear implants or ask if one may be helpful for you to improve your communication. The audiologist may be able to tell you a little more about cochlear implants or refer you to a cochlear implant center.

If time allows during the appointment, ask the audiologist to perform an aided hearing test with your hearing aids to better determine if you may meet the current cochlear implant criteria. Aided information should include a soundfield audiogram with your current hearing aids and a speech discrimination test performed at 55 dB HL (70 dB SPL).

Once contact is made to the cochlear implant center, your records will likely be reviewed to determine how to begin the process and if a cochlear implant is appropriate for you.

**The Process**
The process for getting a cochlear implant typically involves several appointments. The process for adults and children is often different; however, they both include some of the same basic appointments. These appointments may include, but are not limited to:

- Initial Audiological Consultation
- Aided/Unaided Audiological and Speech perception testing
- Computed Tomography Imaging (CT scan)
- Medical Evaluation
- Device Discussion
- Other Appointments

Other appointments may be added to the process. The include: hearing aid fitting; ABR/OAE testing (see below), balance testing; or a psychological evaluation (see page 28).

An Auditory Brainstem Response (ABR) and/or Otoacoustic Emissions Test (OAE) are objective tests that provide information regarding the degree and type of hearing loss without relying on the patient to actively participate in the test procedure. The ABR measures the neural response to sound by recording surface potentials when a click or tone burst type sound is sent into the ear. The OAE provides information about hair cell function by using a probe placed into the ear canal.

The number and type of appointments may vary depending on the cochlear implant center. The order of completion of these appointments is individually determined to best meet the needs of the patient. Surgery is scheduled after the completion of these appointments; provided it is determined that the cochlear implant is an appropriate intervention. Throughout the process, patients may find it helpful to bring family members with them to appointments so that they may also learn what is expected with a cochlear implant.

**The Initial Consultation**
The initial consultation is an information session scheduled with the

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audiolist who will manage your case. During this appointment, the audiolist will review your hearing and medical history. The clinician will discuss audiogram basics (Figure 2) including candidacy criteria.

A brief review of the general anatomy of the ear (Figure 3) with a cochlear implant surgery overview is also discussed during this appointment. The patient receives information regarding current FDA-approved cochlear implant devices.

Finally, the clinician will discuss appropriate expectations for cochlear implantation as well as all pre and post cochlear implant appointments. During this appointment, the patient will have the opportunity to ask questions about cochlear implants. Most patients find this appointment helpful, especially when they are unsure if they want a cochlear implant.

To prepare for this appointment, bring any pertinent medical and hearing history information such as audiograms and medical records. If the center sends you information ahead of time, review this information and fill out all necessary forms prior to the appointment with the audiologist.

Some patients report it is helpful to research cochlear implants on the Internet, or read articles like this one in Hearing Loss, or talk to other people who have cochlear implants for more information prior to the appointment so they can ask more specific questions.

The Testing
The next step of the process is for the cochlear implant audiologist to perform a complete audiological evaluation with the hearing aids to determine candidacy for cochlear implantation. The testing done during this appointment may be similar to tests you have had before; however, it is usually more comprehensive and includes sentence discrimination under various conditions.

Audiological/speech perception testing can take anywhere from 60-120 minutes depending on the number of tests needed for assessment. During this appointment, the clinician will test how well you understand recorded words and sentences using only your hearing aids.
Word and sentence tests are presented at a fixed level (~70 dB SPL) in the sound field while you are wearing your hearing aids. The sentence testing may be performed in quiet and then again with background noise. The background noise testing will give a good indication of how difficult it is to understand in a complex listening situation.

The patient is asked to repeat what is heard and then scored on how many words are repeated correctly, in terms of a percentage. The speech testing is typically completed while wearing both hearing aids and then repeated using each hearing aid by itself. This allows the clinician to determine if one ear has better speech understanding than the other. This can be helpful for the purpose of selecting an ear for implantation.

Additional testing may be performed, if the patient has little to no understanding without visual information on these recorded auditory only tests. These additional tests allow the patient to choose the answer from a list of words or pictures. The words vary from single syllable to two syllables. This test provides information on pattern perception and allows the clinician to have some information as a base line for comparison to results obtained after implantation.

If the clinician (audiologist in this case) feels any previous test results are outdated, incomplete, or that your hearing may have changed, he or she may also repeat the basic hearing test including impedance and middle ear reflex testing.

Impedance is a test where a probe is inserted into the ear, and pressure is increased to determine good mobility of the eardrum. Middle ear reflexes are conducted using the same probe used in impedance testing. The pressure is first equalized and then sounds are presented at increasing loudness levels. The middle ear has small muscles that contract in response to loud sounds and this test allows us to determine how loud the sound needs to be to see a contraction of those muscles. These two tests only take a few minutes, but the patient needs to stay still and quiet during this test to reduce interference in the recording.

Following the completion of the diagnostic evaluation, the clinician will review the test results with the patient. The clinician then may issue some questionnaires to get an idea of the patient’s understanding about the implant and their expectations. There is usually time at this appointment to ask additional questions that may have arisen since the first meeting.

To prepare for these diagnostic evaluations, arrive with your hearing aids in good working order and with fresh batteries in place. If you have questions you wish to discuss at this appointment, write them down so they aren’t forgotten at the time of the appointment. This appointment may take anywhere from 60-120 minutes; so please be prepared to listen and work hard during the entire appointment.

**The Medical Evaluation**

Prior to the medical evaluation, most patients get a CT scan. The CT scan is a radiological film of the temporal bones that allows the doctor to determine if the anatomy is favorable for insertion.
of a cochlear implant. Typically, your insurance determines where you can go to obtain the CT scan.

To prepare for the medical evaluation, the CT scan should be completed in advance of the medical evaluation so that you can hand carry the CT films to the appointment. The doctor will need to see the actual scans and not just the report that comes with it.

The medical evaluation is when you meet the otologist. An otologist is a doctor who specializes in the ear. The otologist will also be your cochlear implant surgeon. During your appointment, the doctor will usually take a detailed medical history, review the CT scan, and determine if there are any medical contraindications to obtaining a cochlear implant. The doctor will give you a review of how surgery is completed and what to expect after surgery. He or she will also discuss the risks associated with surgery. If the doctor feels further evaluations are needed to assess your fitness for the surgery and anesthesia, they will be recommended at this time.

To prepare for this appointment, it is helpful to write down your medically-related questions that you would like to ask at this appointment.

Realistic expectations of what an implant can provide lays a foundation from which successful use of a cochlear implant may begin.

Picking a Device
The last step of the candidacy process involves picking a cochlear implant device. This is usually the choice of the patient, unless the surgeon makes a recommendation based on anatomy. There are currently three FDA-approved cochlear implant devices on the market. At this appointment, the clinician will review the differences among the devices. The clinician may show you demo (display) devices to allow you to see how they look and function. The clinician will also answer questions regarding the devices, surgery and follow-up during this appointment.

To prepare for this part of the process, you should review all available information given to you as well as any additional information you may have received during the process. Many patients report it is helpful to talk with other implant users as well to ask them practical and real life questions.

Of note, not all clinics offer or are able to support all available devices. Please discuss the available manufacturers with your clinician.

We hope this give you a realistic picture of what the initial process is all about. Plan on being well rested and being prepared. It helps to know what you will expect.

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