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HEAR LOSS TREATMENT 1

CONTENTS

1. HOW THE EAR WORKS

Considering its puny size, your ear is an extraordinary instrument. A sugar cube sized piece of equipment, you are able to distinguish all speech sounds along with another nearly half a million other sounds.

Your ears' main function is to collect, process, and send sound to your brain. But that is not all; those two small intricate mechanisms that you have on the sides of your head are also responsible for keeping your balance.

To easily understand how your ear works, you should get to know its three main sections and the functions of these areas. The ear is basically divided into three sections: outer, middle, and inner ear. These three parts are all connected to each other in order for you to hear and process sounds to the brain.

1.1. OUTER EAR: ACOUSTIC CATCHER

The outer ear has two parts; first is the auricle or the pinna, which is the visible external part of the ear, then the ear canal, which may also be called external auditory canal, or external auditory meatus.

The pinna is the part where you usually get a piercing and put your earrings. The main function of your outer ear is to collect sounds, in the form of acoustic waves. If ever you lose your pinna from some accident, there's no need to fret. Although having a pinna has high aesthetic value, it actually has little effect on hearing.

The more important part of your outer ear however is your ear canal, which is the tube that conveys sound waves into your eardrum. The ear canal is also where earwax is produced. The canal is lined with small hair that filters dust and protects the whole tube.

In the end of the canal you would find the tympanic membrane or the eardrum, which separates the outer ear from the middle ear. Your eardrum is a thin membrane that is very sensitive to vibrations. When sound waves reach your eardrum, vibrations occur in the membrane. As the name suggests, your eardrum is like a drum and the sound waves are the drumsticks beating onto it.

1.2. MIDDLE EAR: GOING MECHANICAL

Your middle ear is an air-filled cavity located after the tympanic membrane. In this cavity you will find the smallest bones in your body known as the ossicles. The ossicles or ossicular chain is a chain of three small bones that play an important role in hearing.

It is composed of three bones namely: malleus (hammer), incus (anvil) and stapes (stirrup), respectively. These three bones are named as such, since their shapes somewhat resemble their names. The eardrum is connected to the malleus, which is connected to the incus, which is then connected to the stapes.

When sound waves make vibrations in your eardrum, your malleus is pulled and pushed causing a chain reaction to the other two bones. The sound wave vibrations are then converted into mechanical vibrations. The vibrations travel from your eardrum to your malleus, to your incus, and then to your stapes.

Lastly, your stapes is then attached to the oval window of the cochlea, which marks the start of your inner ear.

1.3. INNER EAR: THE HYDRAULICS

In your inner ear, you would find your cochlea, which is a small, shell-shaped, curled tube. The oval window is a thin membrane in the outer part of your cochlea where the stapes is attached. Your cochlea is filled with liquid; so when your stapes vibrates, your oval window vibrates too; the vibration is then transferred to the liquid inside your cochlea, making the liquid move.

Your cochlea also contains tiny hair cells or cilia. These hair cells are very sensitive to movement. Your ear hair cells are connected to your eighth nerve that is responsible in directing signals that are processed as sounds to your brain.

When the liquid in your cochlea moves, your hair cells, which are submerged into this liquid also moves. When movement stimulates your hair cells, they send signals to your brain through your eighth nerve. Thus, your brain interprets these signals as sounds.

Basically, that is how your ear works—one area affecting another. For the sound to have meaning, it would have to undergo a whole new different and complex process in your brain. Once your brain is able to decode and put it together, then there you have a meaningful message from the sounds you hear!

2. CAUSES AND SYMPTOMS OF HEARING LOSS

Hearing Loss, also known as Hearing Impairment is described as the decrease in the ability of the ears and its other parts to perceive as well as detect sounds. It can happen either suddenly or gradually.

Hearing loss is commonly observed in older adults but it can happen to anyone regardless of race, age or sex. It can range from being a mild to a severe hearing impairment and it can also be temporary, permanent or reversible.

There are different causes of hearing impairment each with its own different symptoms. It all depends on what type of hearing loss and what part or parts of the auditory system are affected.

2.1. CONDUCTIVE HEARING LOSS

One type of hearing loss is called conductive hearing loss. This usually happens when sound is not conducted normally through the external ear (either outer ear or middle ear). This type of hearing loss, however, is considered as a mild type of hearing impairment since the inner ear will be able to compensate for the loss. With this type of hearing loss, there will be no apparent problems in hearing as long as the sound is loud enough and audible enough to be heard.

Conductive hearing loss can be the result of ear canal obstruction, abnormalities in the ossicles, tympanic membrane and the superior canal dehiscence syndrome.

2.2. SENSORINEURAL HEARING LOSS

Another type of hearing loss is called sensorineural hearing loss. Unlike conductive hearing loss, the affected part is that of the inner ear specifically the cochlea. In the cochlea, there's what we call the organ of Corti that has hair cells. Abnormalities in these hair cells can lead to sensorineural hearing loss.

Another not-so-common cause of sensorineural hearing loss is damage in the auditory nerve system. The 8th cranial nerve, also known as the vestibulocochular nerve, is responsible for receiving and interpreting sounds. In very rare cases, this nerve gets damaged which leads to the impairment of the sense of hearing.

In terms of severity, sensorineural hearing loss can be classified as mild, moderate or severe. Most often than not, this type of hearing loss can become severe to a point where impairment can lead to total deafness.

2.3. ENVIRONMENTAL NOISE

Environmental Noise is one of the leading causes of hearing loss and is known as Noise-Induced Hearing Loss. It has been observed that long-term exposure to environmental noise can be detrimental to the auditory ability of a person. In fact, according to some research, people who live near freeways and airports are more prone to have their ability to hear impaired.

Multimedia devices such as mp3 players are also known to cause Noise-Induced Hearing Loss. It is because headphones and earphones are nearer to the eardrums compared to the standard speakers. If exposed to these kinds of devices for a long time there is a good chance that hearing loss can occur.

2.4. GENETIC

Some people may not know, hearing loss is genetic which means that it can be inherited. This illness is passed through the descendants either through a dominant or a recessive gene. If it involves the dominant gene, deafness can likely happen to at least one relative every generation. If it involves the recessive gene, then it may skip generations but definitely, the risk of acquiring it is still there.

Hearing loss caused by genetics is usually apparent by the time the baby is born. One type of congenital hearing defect is known as Connexin 26 deafness. Other common hearing impairments caused by the dominant gene are Waardenburg syndrome and Stickler syndrome. Hearing impairments caused by the recessive gene are Usher syndrome and Pendred Syndrome.

2.5. ILLNESSES

There is also a possibility that hearing loss can be caused by the current health condition of a person. It has been noted that measles can cause damage to the auditory nerve that could lead to hearing loss. Another illness that can cause hearing impairment is meningitis that, just like measles, can also damage the auditory nerve.

Illnesses that involve the immune system are also candidates for causing hearing loss. These illnesses include HIV and AIDS.

2.6. MEDICATIONS

Some medications can cause permanent damage to the ears. This is called ototoxicity. The most common group that is known to do this is the aminoglycosides like gentamicin.

There are, however, other medications that may cause temporary hearing loss. This includes NSAIDs, diuretics and even aspirin.

2.7. PHYSICAL TRAUMA

Physical injury to the ear, especially if some parts of it get damaged, can cause hearing loss. However, physical trauma does not only pertain to the ear but also to the whole head. If the head gets hit and the vestibulocochular (auditory nerve system) gets damaged, then hearing impairment is imminent.

3. TREATMENTS OF HEARING LOSS

Hearing loss is defined as the decrease or total loss in the ability to hear and perceive sounds. Although this is more commonly observed in older adults, it can affect anyone regardless of race, age and sex.

3.1. HISTORY OF HEARING LOSS AND TREATMENT

As of now, 1 out of 6 older adults are affected by this illness thus the rapid development of different hearing loss treatments. In the olden days around the 1800s, people didn't actually take hearing loss seriously that's why no actual study or treatment has been developed.

In the 1900s, the very first hearing aid was patented but was not popularly welcomed since most still did not acknowledge hearing loss as an illness. A couple of decades after, people became aware of hearing loss and developed different ways of helping sufferers. Pictures and images are sometimes used to convey message to people who have hearing loss. Although hearing aids already existed, not everyone can afford them.

As technology grew, so did the opportunity to help people who have hearing impairment. Hearing aids have become more affordable and more effective and several other ways of treating hearing loss have also been developed.

3.2. CAUSES OF HEARING LOSS

The kind of treatment a person suffering from hearing loss gets depends on what caused the illness. So to better understand the different treatments of hearing loss, a background on the different causes of the illness would be helpful.

One of the most common causes of hearing loss is genetics. Hearing loss is a genetic condition that can be passed down from generation to generation. It can be passed down whether it is a dominant trait or recessive trait of the family. Hearing loss in this case usually manifests as a congenital defect meaning people have had the condition ever since they were born.

Another cause of hearing loss is physical trauma. A damaging hit on any part of the ear, whether external or internal, has the possibility to result in hearing loss. The same thing can happen if the head gets bumped on a hard surface. The 8th cranial nerve (vestibulocochular), also called the auditory nerve system, can get damaged when the head also gets damaged.

Environmental noise is another cause of hearing loss. Long-term exposure to a noisy environment, such as living near the freeway or the airport, offers a big chance of developing this condition. The use of multimedia devices such as iPods also plays a role in hearing loss.

Obstruction in the ear way is another possible cause of people losing their ability to hear. Also, taking of ototoxic medications have been known to result in hearing impairment.

Last but not the least, ear infections like otitis media, can also be factors that affect a person’s ability to hear. Other illness may also produce the same effects

3.3. TREATING HEARING LOSS

Most of the time, when the cause of hearing loss is due to infections, only antibiotics are given to fight off the bacteria. This usually solves the hearing loss problem. The same can be done about illnesses that affect hearing. Instead of treating the hearing loss directly, the target if treatment is the illness itself. If the illness gets treated, the hearing impairment problem also gets treated.

For hearing loss caused by obstruction in the ear way, a visit to the EENT usually does the trick. The obstructing object is removed and the hearing loss problem is solved.

But for the more serious causes of hearing loss, a more serious approach is needed. For hearing loss caused by old age or natural declining of hearing abilities, the most common treatment given is the hearing aid. This is the most common, affordable and effective way to live through with healing loss.

Other than hearing aids, modern technology has developed ways on how to help people with hearing disabilities. Two of these are called the Cochlear Implants and the Assistive Listening Devices. Cochlear implants are given to those who have parts in their cochlear damaged. On the other hand, Assistive Listening Devices (ALDs) work differently. The ALD acts like a receiver while a speaker uses signals and inputs from a transmitter.

For hearing loss caused by ototoxic medications, patients are advised to stop taking these medications and eventually, normal hearing will be restored.

4. HEARING TESTS

An ounce of prevention is better than a pound of cure. This principle also applies to anyone with a hearing loss condition. The earlier the illness is detected, the better its prognosis is. However, for those who already are afflicted with the illness, hearing tests are done to see whether hearing has improved or not and whether treatments have been effective.

Hearing tests are actually a standard part of any ear examination. Basically, it assess a person's ability to hear and perceive sound. This is done through measuring whether sounds are able to reach to the brain.

Hearing tests are also done for babies. Since these little tykes can't express subjective opinions yet, doctors can't be too sure whether they have normal hearing or not. Because of this, babies are subjected to hearing tests for the early detection of problems that pertain to factors that may interfere in the development of speech and other cognitive abilities. Hearing tests for babies are very important to detect any congenital hearing defect such as hearing loss.

Hearing tests are also very important on children during school age. Although people can learn visually and kinesthetically, hearing still plays a very big part in the absorption of this information. If a child has hearing problems, then learning may be impeded. This is the reason why hearing tests are done to detect whether a certain child has hearing loss or not. If tests turn out positive, then appropriate actions can be done immediately.

For persons who are suspected of having hearing loss, the severity as well as the type of hearing loss can then be detected and established. With this, appropriate treatment and medication may be given to improve the condition of a patient. Hearing tests would also be used as an evaluative tool whether a person's hearing condition has improved or not.

4.1. WEBER TEST

Named after Ernst Heinrich Weber, the Weber Test is considered as one of the most basic hearing tests for detecting hearing loss. This test will be able to detect two types of hearing loss: unilateral conductive hearing loss and unilateral sensorineural hearing loss.

The Weber Test makes use of a tuning fork. The fork is struck on a surface to produce vibrations. It will then be placed on top of the media lateral of the skull. A person is said to have a unilateral conductive hearing loss if one ear hears the sound louder than the other. The ear that hears the louder sound is the affected one.

4.2. RINNE TEST

Just like the Weber test, the Rinne Test also uses a tuning fork. This hearing test was named after Heinrich Adolf Rinne, the person who developed this test. The Rinne Test compares how sound is perceived as conducted through the mastoid.

A tuning fork is struck to produce vibrations. The fork stem is then stuck on the mastoid of a person. When no sound can already be heard, the fork is then placed outside the ear.

Although the Webber Test and Rinne Test have been proven to be effective, these can't be compared to the hearing test called audiometry.

4.3. AUDIOMETRY TESTING

Audiometry is the formal testing of a person's hearing ability. With the help of an audiometer, the hearing level of a person may be measured. It may measure the ability of a person to differentiate between different intensities of sound, distinguish speech from background sounds, or recognize pitch. In audiometry, otoacoustic emissions as well as acoustic reflex can also be measured. Results from audiometry testing can be used to diagnose whether the subject has hearing loss or other problems with the ear.

Unlike the Weber Test and the Rinne Test, audiometry testing needs a special soundproof room. It also does not make use of tuning forks. Instead, it uses a device called the audiometer.

4.4. TYMPANOMETRY

Tympanometry is a test usually used to detect hearing conductive hearing loss. It is also used if nothing apparent is detected through the Rinne and Weber Test. This procedure makes use of an otoscope. This makes sure that nothing; neither foreign object nor earwax is blocking the path to the eardrum. It is considered as a foolproof method if ever the findings from the other tests produce suspiciously inaccurate or anomalous results, and further tests are needed for deeper hearing level assessment.

Tympanometry targets the eardrum's mobility, conduction of bones, and the condition of the middle ear.

5. TYPES OF HEARING DEVICES

5.1. WHAT ARE THE VARIOUS TYPES OF HEARING DEVICES

A hearing aid is a hearing device that you can use to help amplify sounds. If you have hearing loss you can use a hearing aid so that sounds in your environment would be amplified, enabling you to hear them at an audible level. It can be useful in both noisy and quiet situations.

Your hearing aid basically has three parts: the amplifier, microphone, and speaker. Your hearing device works by receiving sounds through its microphone, which translates the sound waves collected to electrical signals that are sent to its amplifier. The amplifier is the one responsible for increasing the intensity of the signals, which are sent to your ear through the device's speaker.

There are several styles of hearing aids that you can choose from. Each style has its own pros and cons. It would highly depend on your preference on which style you would want to use.

5.2. BEHIND-THE-EAR (BTE) HEARING AIDS

This style of hearing aid is the largest, yet it is also the most powerful. It comes with a hard plastic case that is worn behind your ear, which is attached to a plastic earmold that is placed inside your outer ear. All the electronic components are placed in the plastic case behind your ear.

Behind-the-ear hearing aids are suitable to be used for all degrees of hearing loss. Another good point is that it can be inconspicuous, since it doesn't give that "plugged-up" feeling in your ears.

However if you are wearing glasses, this type can be difficult for you, since the device can interfere with the arms of your glasses. You can also have difficulty in using the telephone due to the placement of the microphone, which is behind your ears.

5.3. IN-THE-EAR (ITE) HEARING AIDS

This type is the largest of the custom made styles, and is only used for mild to moderate hearing loss. The device is completely fit inside your outer ear; that's why it can give you more occlusion effect than Behind-The-Ear type of hearing aid.

Some In-The-Ear hearing aids may come with extra features installed; like a telecoil, which is a magnetic coil that can make it easier for you to converse over the telephone. This type of hearing device is usually not used by young children, because as children grow, the ear moulds have to be replaced often.

5.4. IN-THE-CANAL (ITC) HEARING AIDS

The In-The-Canal (ITC) type of hearing aid is customized to fit the shape and size of your ear canal. It is generally used for mild to moderate hearing losses. Using the telephone would not be a problem with this type. But you can get the occlusion effect or that 'plugged-up' feeling that can be very uncomfortable. You would also need more dexterity to control the knobs of the device.

5.5. COMPLETELY IN THE CANAL (CIC) HEARING AIDS

This is the tiniest hearing aide made that is nearly hidden in your ear canal.

The CIC hearing aids do not have manual controls, and are used for mild to moderate hearing losses.

These are very expensive, and are vulnerable to moisture and wax. The good thing is, they have less occlusion effect than the other types and the use of the telephone is very easy. Since they are small, CIC hearing aids have less room for batteries, making their battery life shorter than the other types.

5.6. TYPES OF PROCESSING

Other than styles, you can also choose the type of processing of your hearing aide. There are basically three types of processing namely: analogue, analogue programmable and digital programmable.

Analogue aids are the oldest type and the least expensive of the three. They are usually designed with a particular response based on your audiogram results. These amplify all types of sounds, whether it is speech or noise, in the same way.

Analogue programmable can be set for different situations for quiet or noisy settings. A computer is used to program the device, which is based on your hearing loss profile, range of tolerance and speech understanding.

The digital programmable aids are the most sophisticated and most expensive of the three. It is self-adjusting to whatever setting you may be in. It has all the features of analogue programmable devices but uses digitized sound processing. It is the most flexible because it is able to manage feedback and noise, as well as loudness levels.

6. HEARING LOSS AND SPEECH

6.1. WHEN HEARING LOSS AFFECTS SPEECH

Hearing loss due to other disorders is prevalent. The thing with hearing loss is that it can cause other problems too. But that would highly depend on when you acquire your hearing loss, and the severity of your hearing loss. For instance, you can develop speech problems when you have hearing loss.

6.2. RELATION OF HEARING AND SPEECH

Most people who have speech problems due to hearing loss are those who already had hearing impairment as children even before they were able to speak.

The relationship of hearing and speech is quite simple. Babies learn to speak by imitating what they hear. As an infant's hearing mechanism develops, the more he becomes attentive to his environment.

At first they observe what they see, then as their hearing develops further, they learn to localize the sounds that they hear. Meaning when they hear a rattle's noise from their right even if they don't see the toy itself, they can turn their head towards the same direction where they heard the noise if their curiosity is heightened.

When babies fully learn to localize, then they start to learn to experiment on their vocal mechanism. At first, all they can do is cry. That is the first voiced activity they can do, although involuntarily. As they grow they learn to control their voices, by imitating what they hear in their environment.

At first, they make grunting noises, and then they coo, and then come the point that they babble, and soon after, you can hear them saying their first repeated syllables then the climax comes when they are able to say their first word. All of these are possible because of adults whom they hear in the environment talking to them.

So if you have impaired hearing from the time you were born or acquired hearing impairment before your period of normal speech development, which is from two to five years old; you would definitely have speech problems due to your hearing impairment.

But if you acquired hearing loss when you are in the stage of life that you are already able to talk normally, then you wouldn't have to worry on having speech problems. All you have to worry about is hearing correctly what people are telling you at the moment.

6.3. RELATIONSHIP OF SEVERITY TO SPEECH

The severity of the speech problem that you have can vary depending on the severity of your hearing loss. For example, if you have mild hearing loss, most of your speech problems would only include difficulty in the

distinction of tense, plurality and possessives. Not hearing subtle conversational cues can also cause you to react inappropriately when talking to others.

When you have profound hearing loss, you can probably detect sound but not discriminate speech by wearing a hearing aide. In cases like this, speech alone is not enough to communicate; you would have to use other means of communication such as sign language and the like.

6.4. CONDITIONS LEADING TO HEARING LOSS IN CHILDHOOD

Since hearing loss during childhood is the kind of hearing loss that can affect your speech, you should get to know what are the risk factors and conditions that can lead to hearing loss during childhood.

Congenital hearing loss is the type of hearing impairment that is already present when you were born. Several factors and conditions can lead an infant into having congenital hearing loss.

Some of these factors include complications in pregnancy and delivery, mother's use of ototoxic drugs like antibiotics, use of abusive drugs, anoxia (lack of oxygen) during delivery, jaundice, and premature delivery. Different conditions of congenital hearing loss would be otosclerosis, and sensorineural conditions.

Sometimes, structures are the main problem of hearing loss at birth. There are times that babies have physical defects of not having an eardrum or one of their ossicles are not moving, which should not be the case for normal ear physiology.

Presence of syndromes like Achondroplasia, Alport's syndrome, Apert's syndrome, Crouzon's syndrome, Down's syndrome, Treacher-Collins syndrome, and Waardenburg's syndrome can cause congenital hearing impairment.

However, you can also acquire hearing loss while you're still an infant. If you have severe fever as a baby, and you were treated with very powerful antibiotics, this can lead to hearing impairment, along with having rubella, mumps, measles and chicken pox during infancy.

All these conditions when left unmonitored can all lead to hearing impairment in childhood, then to speech problems in adulthood.

7. WEARING HEADPHONES

7.1. ABOUT WEARING HEADPHONES

We are all accustomed to seeing, and perhaps even wearing headphones whenever we need a little dose of music without disturbing others. A couple of earpieces, connected to a jack, are inserted to an electronic handheld device or even a cellular phone that is capable of playing back music.

We have different reasons for using headphones actually. Some of us use these small devices as a means of relaxation while doing strenuous work, like working out in the gym. Some may use these devices because they are in a public place that promotes some form of decency and politeness of not being too publicly loud. Others may even use them because of the need of keeping whatever they are listening to for themselves, not wanting to share any information which might prove quite private.

However, many of us do not know or are not actively aware that using these small wonders of technology can actually affect our hearing in a way that they may be caused by physiological impairment.

We may have our hearing affected due to the misuse of headphones as we try to drown out the noise in the environment, but actually only substitute another and much more acceptable form of sound with the same level.

7.2. WHEN OUR EARDRUMS GET THE BEATING

Everyday, we hear all sorts of sounds, some of them louder than the rest, while some are outright appalling and unacceptable to our perception. These may be sounds that are too loud for our ears to perceive or because these bring about awful thoughts and ideas which we personally abhor and detest. Even when we sleep, our ears are able to detect sounds as they are, but the mere fact that our minds are consciously inactive would not allow us to be aware of sounds as distinct as they should be when we are awake. Nevertheless, our eardrums are still able to detect these sounds and would still be subject to damage not based on our conscious perception but to the raw sound level that reaches our ears.

This is most evident whenever we accidentally fall asleep with our headphones on. Having them plugged into our ears as we fall asleep pose a great risk on abusing our eardrums without rest from the constant vibrations brought about by the sound focused straight down our ear canals. Imagine a 6-hour sleep at least with constant barrage of sound to our ear. It would have been all right if the sound has not been too loud beyond normal threshold. Safe levels of sound would be around 60 to 70 decibels, roughly equivalent to a person playing the piano. Exposing our ears in this manner would require only a progressive diminishing amount of time of exposure as the decibel rate goes higher.

It is even much healthier to be aware of the sounds in the environment rather than isolate yourself with your own preferred sound coming from the headphones. In comparison, a similarly produced sound level produced from an environmental stimulus is better and safer than that coming from the headset mainly because the

former would still have to travel a long distance towards the ear, and much of the vibrations would have been dispersed as it hits the outer ear.

Furthermore, there would have been already waste in the amplification level of sound as it travels through the media, which in this case is the atmosphere. By the time the sound reaches the eardrums, the sound would already have been lessened in effect, and thus the eardrum would not have to take the whole brunt if ever the same level of sound came from the latter.

7.3. SLOWLY BUT SURELY

As our ears are constantly exposed to the brunt of the direct sound on the eardrums because of the headphones, and for prolonged periods of time, the damage of excessive levels of sound on our eardrums may sooner or later accumulate and before long, we may detect the very first signs of semi-permanent hearing damage.

Headphones are very convenient and so useful that we tend to abuse their purpose. Just like anything, excessive use may be detrimental and might cause future complications. Too much usage of headphones may accustom our ears to a higher level of sound and "desensitize" them to the point that whenever we start listening to the normal sounds of the environment, we have a higher threshold of sound to perceive.

The constant effect of headphones on our ears in this manner may result in us having slight problems like tinnitus, which is characterized by the faint "ringing" of the ears.

8. HEARING AND YOUR JOB

Different people have different jobs, entailing different levels of stress, enduring different intensities of workload, and definitely being exposed to diverse environments, each with their own levels of sound or noise.

8.1. THE NOISY WORKPLACE

While we are at work, it is inevitable that we are exposed to the myriad sounds and noises in the workplace. Even in the most enclosed corporate offices, noise may be as loud and intense as those outside in the street. The sounds of telephones ringing, fax machines beeping, copiers whizzing, colleagues engaged in talks with their respective clients, and of course the buzzing sounds of those who have nothing to do yet.

These may be as noisy as those who work outdoors like repairmen and construction workers. There are even those who are exposed to far worse unrelenting noise barrage like airports and heavy construction sites.

A human has a normal sound level threshold of around 60 to 70 decibels. This unit is the measurement of the intensity of sound that our ears receive and is subjected to our eardrums. For normal workplaces, the intensity

does not usually go beyond 80 decibels, which is still at the upper limit of human hearing threshold. Anything higher than this, like say 85 degrees may have an effect on the hearing over time due to long exposure.

This long exposure has a significant correlation with the nature of work of a person because normally, that person is exposed to the same amount of sound for several hours. Those who are in airports and working on heavy machinery like pneumatic drills and such are subjected to around 130 and 100 decibels, respectively. This is also present with those people who frequent rock concerts, especially when they are situated in front of the loud speakers, who at some point of the program may experience as high as 150 decibels, which is already way beyond the maximum tolerance.

These people who are working in an environment with more than 90 decibels for a long period of time are advised to use measures to prevent complications and the possible loss of hearing due to negligence of proper health.

8.2. PREVENTION WHILE WORKING

There is still no better solution to possible hearing loss than preventing it from happening rather than stopping it from progressing into a worse state. There are already laws and provisions in many countries requiring employers to make sure that the health of their workers, especially those who are in a high risk noise situation are well protected, provided, and educated regarding safety measures and precautions with the sound intensities.

Usually, the general provision is to equip the workers with hearing protectors specially designed to cover the whole ear part that can detect and funnel in sounds towards the inner ear. It may be a combination of earplugs, earmuffs, or both for better protection.

The earplugs serve as a direct buffer for sound that may pass through the earmuffs. The earmuffs then are responsible for the initial dampening of the first wave of sound intensity. These are supposed to be given by the employer to their employees upon beginning of the work contract in a job requiring such equipment.

Each ear protective gadget can effectively lower the sound intensity by as much as 20 to 30 decibels. An added earplug to an earmuff may reduce as much as 30 to 40 decibels combined, the former filtering low frequency and the latter high frequency. It doesn't necessarily mean that once that you are equipped with the necessary ear protection for your work, you may just stay there and take the brunt invincibly.

It is still suggested that even with those on, one has to veer away at the soonest possible moment, especially if there is nothing more to do. This would illustrate an airport guide wearing protective ear gear and is being exposed to a jet's shrieking engine noise of about at least 120 decibels. With about 80 to 90 decibels going through the ear after the protective gear, it would be wise for that airport guide to go back to a safer and quieter place after the airplane has taxied off.

It is best to choose your work and determine if the risks involved, including hearing loss is worth the compensation benefits.

9. WHAT IS USHER SYNDROME

Usher syndrome is the most prevalent condition that affects both vision and hearing. Being a syndrome, it means that this condition is a disorder or disease that has a range of features or symptoms.

9.1. SYMPTOMS OF USHER SYNDROME

The main symptoms of this condition are hearing loss and Retinitis Pigmentosa, which is an eye disorder. Retinitis Pigmentosa can cause you night-blindness. Your peripheral vision is lost too. All of these happen because of the progressive degeneration of your retina.

As Retinitis Pigmentosa progresses, your field of vision would narrow, developing into another condition called “tunnel vision”. With severe tunnel vision, you are only able to see the central vision. That’s why severe balance problems are also an issue for a lot of patients with Usher syndrome.

9.2. CAUSE: GENETICS

Usher syndrome is an inherited condition. This means that it is inherited from parents to their kids through their genes. Genes are found in roughly every cell of your body. Basically, genes contain blueprints or instructions that tell your cells what to do.

Everyone inherits two copies of one from each parent. Sometimes your genes can be mutated, or altered. When mutation occurs, this can cause your cells to malfunction.

When you inherit Usher syndrome, it is an autosomal recessive trait. Since it is autosomal, this means either male or female can acquire the condition and is able to pass it to their child. However, since it is also recessive, this means that in able for a child to acquire Usher syndrome, he should receive both mutated genes from both parents.

So basically, if the mom has a normal gene, and the dad has a mutated gene, their child would still have normal hearing and vision. Sadly, if each parent carries a mutated gene, they would have a twenty five percent chance of having a baby with Usher syndrome per childbirth.

Most of the time, parents who have normal vision and hearing are not aware if they are carriers of a mutated gene for Usher syndrome. At present, it is not yet possible to detect whether you are a carrier of the gene, even if you have no family history of Usher syndrome.

9.3. TYPES OF USHER SYNDROME

Basically, there are 3 clinical types of this condition: type 1, type 2, and type 3. According to data, types 1 and 2 are the most prevalent types in the United States. Both of them are responsible for approximately 90-95 percent of cases of children having Usher syndrome.

Type 1

Profound deafness during birth and severe balance problems are the main symptoms of Type 1 Usher Syndrome. Most kids with this condition have little or no benefit at all from hearing aides. As early as possible, you should consult your doctor or audiologist if your child has this type of Usher Syndrome, so that you can find other communication methods for your child.

You should seek intervention early, so that your child can optimize the unique period of time in which their brain is most open and receptive to learning language, whether it be signed or spoken. If your child is diagnosed with this condition early on, before he or she even loses his or her ability to see, then your child would likely benefit from the intervention strategies that can aide him or her with activities of daily living.

Type 2

Kids with Type 2 Usher syndrome usually have moderate to severe hearing loss. The good thing is that they have normal balance. Due to the varied severity of hearing loss, most of these kids can benefit from using hearing aids. They are also able to communicate orally. Their visual problems also progress slower than in type 1.

Type 3

Children with this type of Usher syndrome do not have hearing loss at birth. Most of them have normal to near-normal balance skills, but some can develop balance problems later in life. Their sight and hearing also worsen over time. The thing is, the rate in which they worsen could vary from one person to another, even if they belong in the same family.

A person with this kind of Usher syndrome can develop hearing loss by adolescence. Then, he or she would have to use hearing aids only by reaching the age of mid- to late adulthood. In this type, night blindness typically starts at some point in puberty. Blind spots can appear by during the late teens up to early adulthood. When you reach mid-adulthood, you can be diagnosed as legally blind.

10. VISION AND HEARING LOSS

There are many studies being conducted which aims to relate hearing loss to the occurrence of vision loss among those affected by the former. Though there are many factors that may be included in such occurrences, such as genetic framework, diseases, normal aging process, and other patho-physiological factors.

10.1. IN CONTEXT

Vision loss in this manner is considered as the impairment of sight brought about by the any related factors that will generally reduce the quality of vision from 20/20. Complications and difficulty in seeing by the patient will be attributed to the occurrence of hearing loss as well. Some of the possible sight impairments would be maculopathy or the loss of keen sight by the macula, possibly due to a disease or physiological condition.

Hearing loss may be attributed to the lessening of sound from normal situations. This may be signified as a sign or symptom in which there is a difficulty in assessing the sounds being heard, difficulty in identifying them and judging the correct intensity. This impairment or progressive degradation may be attributed with physiological damage brought about by abuse in work noise environment, aging, disease, and the like.

10.2. OLD AGE

As we tend to mature, our cells start to degrade. Even with new cells being produced in replacement of old ones, the vital parts of our bodies are not able to efficiently keep up with the amount of cells that die each day due to normal aging process. This is as well as radicals which hasten the life span and lessen the functionality of our cells for normal metabolism.

Our eyes and ears, as well as the supporting nerves and supportive tissue also experience degeneration and degradation as we age.

On a similar note, there have been studies that strongly suggest that hearing and vision loss are related in a way that they occur almost one after the other once aging sets in.

Though current studies cannot accurately pinpoint the exact reason or physiological factor responsible for the relationship of the two happening, the mere idea that the instances of hearing loss happening after vision would mean that there is at least a contributing factor.

Studies have shown that there is at least 9 percent chance that aging individuals having at least one of the impairments developing the other. The possible angles of concern regarding this is that the nerves carrying the signals and actuating the sensory nerves and the sensorineural network may have started to degrade and lose its efficiency, therefore causing complications in proper sight and hearing.

What the scientists and researchers are trying to determine is the actuality that the sensory network of the cranial nerves responsible for the specific organ functions are related to one another and that aging is affecting a certain part of the whole neural framework, thus contributing to multiple chances of complications with other senses.

10.3. DIABETES

Other studies have shown through statistical data that diabetes may be causing the progressive complications and impairments of the hearing process as well as the visual process. The effect of diabetes, even among younger people is the inability to properly supply the correct amount of blood with nutrients and thus limiting the amount of oxygen being carried out to these organs and supporting tissues. Similar with any other cardiovascular disease, the decrease in a sufficient amount of blood supply may cause the commencement of the degradation of the nerves involved for the cranial areas such as the eyes and the ears.

The direct effect of diabetes on the hearing loss pattern is brought about by presbycusis that is characterized by the gradual loss of sensorineural perception of an individual and is determined by a higher intensity in sound hearing. This is also still being studied if the amount of proper oxygenation and nutrient distribution by an unhealthy cardiovascular system may lead to the same effect on the visual aspect of the human physiology.

Until now, the occurrence of hearing loss and visual loss are both dependent on the occurrence or presence of a manifesting disease such as Goldenhar, and Down's syndrome. Even if research has found visual loss as a prior manifestation before a hearing loss, the former loss is still attributed to the disease which caused it and could also be linked to the latter loss of physiological functions.

Nevertheless, constant and further studies are being conducted to isolate and understand the nature of hearing loss as characterized by the onset of visual loss.

11. WHAT IS ACOUSTIC NEUROMA

Every year, several thousands of individuals are diagnosed with acoustic neuroma. The effects can be devastating if left untreated due to the variety of harsh symptoms. There is hope for early detection, however, which is why people need to be more aware of the stages as well as the methods that help prevent the condition. Here’s more about the dreaded tumor.

11.1. A BRIEF OVERVIEW

Acoustic neuroma also goes by the names vestibular schwannoma, acoustic neurilemoma and acoustic neurinoma. The condition begins through a benign intracranial tumor in the cells that form the myelin of the vestibulocochlear nerve or the nerve that links the ear to the brain.

Initial speculations indicate that the tumor may have originated in the acoustic region. However, when experts later on found it on the 8th cranial nerve, they then created the term vestibular schwannoma. The tumor is initially small and progresses at a slow pace. In the United States, around 3,000 patients are diagnosed of having the condition every year. 1 out of every 100,000 individuals all over the world has acoustic neuroma affecting both sexes and most usually older adults.

There is one known risk factor for the condition that is being genetically passed on the disorder called neurofibromatosis 2. This rare condition predisposes individuals to developing benign tumors on different cranial nerves most particularly the vestibulocochlear nerve. Since the tumor affects the ear-brain connection, hearing loss is almost impeccable. The tumor presses on the region responsible for hearing as well as the brainstem. If the tumor gets too large compressing the brainstem, the situation can end fatally.

Several cases of acoustic neuroma are described as having a slow growth pattern lasting decades. The disadvantage is that people may not notice signs and symptoms until the problem is already rather large. Those aging from 30 to 60 years old should start undergoing diagnostics even without any obvious symptoms. It is also possible for the tumor to remain small and free of symptoms.

11.2. SIGNS, SYMPTOMS AND DIAGNOSIS

Acoustic neuroma may be difficult to detect and diagnose since symptoms can take years to manifest and are usually similar to other middle ear problems. The earliest symptoms of the condition would be ipsilateral sensorineural loss of hearing or deafness, gait alteration, disturbed sense of balance, vertigo with associated nausea, ear pressure and vomiting. Tinnitus is also a common symptoms experienced by over 80% of patients which is characterized by unilateral high-pitched ringing in the ears.

A small tumor is referred to as intracanalicular since it remains inside the bony internal auditory canal that will produce symptoms like hearing loss, tinnitus, dizziness or vertigo.

A medium-sized tumor extends into the brain cavity without pressing on the brain which will produce symptoms like greater hearing loss, headaches together with vertigo, facial numbness, reduced eye sensation and difficulty balancing.

A large tumor extends into the brain cavity and presses on the brain producing symptoms like facial twitching and weakness, hydrocephalus, headache, double vision, loss of taste, altered gag and swallowing reflex and visual loss.

There are a number of diagnostic tools to confirm acoustic neuroma after noticing the signs and symptoms. Computed Tomography or CT scan of the head will be able to show the presence of tumors larger than 2 centimeters in diameter and projecting over 1.5 centimeters into the cerebellopontine angle. Magnetic Resonance Imaging or MRI will also detect growths. Audiology and vestibular tests will check the severity of hearing loss through air conduction and bone conduction.

11.3. TREATMENT AND PROGNOSIS

There are three main treatment approaches for acoustic neuroma namely observation, partial or total microsurgical removal and radiation. If the tumor remains small or growth is very slow with no signs or symptoms, the doctor may opt to monitor the patient regularly only to prefer other alternatives if the condition becomes worse. Imaging and hearing tests will be done regularly as scheduled by the doctor to constantly check any signs of progress.

Total or partial microsurgical removal refers to manually removing the tumor by creating an incision in the patient's skull. This is a preferred option if the tumor is getting large and pressing on the brain. Radiation involves radiation beams being directed and applied on the tumor site. This is used if the patient does not like having a skull incision. The effects take longer as well and do not damage brain tissue. The risk of surgery and radiation is permanent hearing loss.

The prognosis for acoustic neuroma is actually good especially if the tumor is detected early on. There may be possibilities of tumor regrowth requiring repeat treatment and some symptoms may remain for the long term of permanently such as tinnitus and hearing loss.

12. MENIERE'S DISEASE

Although Meniere's Disease has existeed for over a hundred years, it still remains to be a very mysterious condition. The disease has a very unpredictable progression, no real known risk factors and causative agents and no known cure. A lot of experts and doctors are still trying to find ways in order to help patients cope with distressing symptoms like hearing loss.

12.1. DEFINITION OF THE DISEASE

Meniere's Disease was named after the French physician who first discovered and described the condition in 1861, Prosper Ménière. The condition is a disorder of the inner ear wherein its normal fluid balance regulating system is not functioning properly. The problem would then result in a variety of symptoms like episodes of dizziness or vertigo, tinnitus or high-pitched ringing in the ears, feeling of pressure or fullness in the ear and on and off hearing loss. The entire labyrinth including the cochlea and semicircular canals are affected. The disease affects both males and females usually aged 40 years old and above.

The episodes of symptoms can occur in clusters wherein several attacks occur simultaneously within a small amount of time. It is also possible for episodes to relapse and recur after a number of years. After acute episodes, patients usually experience absent or mild symptoms of tinnitus and lack of balance.

Most cases of Meniere's Disease begin with one affected ear then later on progresses to affect both ears. In a span of 30 years, around half of all patients have both ears affected. An acute episode can be temporarily debilitating but the disease is never fatal.

Meniere's Disease is not very rare affecting only an estimated 0.2% of the American population. There is no true known cause for the condition although some suggest that fluctuating pressure of the fluid found inside the inner ear or hydrops is contributory. The membranous labyrinth is a system of membranes inside the ear containing fluid called endolymph. When pressure increases in the ear due to reasons like blockage of the endolymphatic duct, the membranes dilate. If the pressure becomes too great, the thin membrane between the endolymphatic and perilymphatic chambers can rupture causing fluids from both chambers to mix. Since the fluids have different chemical properties, the inner ear experiences trauma.

12.2. SIGNS AND SYMPTOMS

A usual episode of Meniere's Disease may begin with one ear feeling full, with hearing fluctuations or hearing different high-pitched ringing sounds. Other symptoms eventually follow such as vertigo or dizziness, lack of balance, nausea and vomiting. On the average a single episode can last anywhere from 2 to 4 hours. Clusters can also occur within that timeframe. Other symptoms include short shocks, sudden falls and unsteadiness. After episodes especially severe ones, patients feel very tired and need to rest and sleep for several hours.

Meniere's Disease attacks are incapacitating and unpredictable. Some cases may be very severe lasting for a number of days. Hearing may get better after an episode but later on becomes worse. Sounds will seem distorted or tinny for patients while others may experience hyperacusis or unusual sensitivity to sounds. Other uncommon symptoms include nystagmus or jerky eye movements, pulsion or feeling of being pushed or pulled, brain fog and depression.

12.3. TREATMENT AND PROGNOSIS

During an attack or once vertigo starts, the patient should be laid down on a firm surface while fixing his or her eyes on a stationary object or point. Water should be avoided to prevent vomiting. The patient should wait for the symptoms to subside and disappear before slowly getting up. Sleep is needed to treat exhaustion.

The treatment approach focuses on helping patients deal with immediate symptoms as well as prevent recurrence. Vestibular training, stress reduction, medication, hearing aids and tinnitus-alleviating methods are employed. A special diet should also be followed to reduce the possibility of recurrence. Patients are put on a low-sodium diet taking aspartame and lipoflavonoid and staying away from caffeine, tobacco and alcohol.

Medications may also be provided to help reduce inner ear pressure such as diuretics, antihistamines, steroids, anti-herpes like Acyclovir and anticholinergics. Surgical means may also be employed such as labyrinthectomy. This involves removing the inner ear, vestibular neurectomy which involves cutting the nerve leading to the balance region of the inner ear or surgically decompressing the endolymphatic sac. Chemical labyrinthectomy involves surgically destroying the balance region of the inner ear if only a single ear is affected.

Although not lethal, Meniere's Disease is an incurable condition and symptoms like hearing loss, tinnitus and vertigo may remain for the long term. Some effects can be alleviated or permanently be treated. Hearing actually gets worse later on and some surgical approaches can cause deafness.

13. TINNITUS

For millions of people suffering from hearing loss and other ear problems, tinnitus may be one of the most obvious symptoms. There are variations to this type of hearing perceptions as well depending on the severity of the condition as well as the areas affected. Learning how it develops and progresses will further help patients cope with temporary and long term effects.

13.1. A SHORT DESCRIPTION

Tinnitus is not a disease but a symptom. The term originated from the Latin word which means “ringing” since patients who have it perceive high-pitched ringing sounds at varying degrees and durations. Even without the presence of actual external sounds, the affected individual may still perceive or hear noises in one or both ears or in the head. Tinnitus is part of the compensatory mechanisms done by the auditory system due to underlying factors.

The ringing or noise perceived by affected persons is usually described as high-pitched buzzing, hissing, whistling, humming or whining similar to a boiling kettle. Others may also describe it as ticking, roaring, pulsing, clicking, beeping, whooshing or swishing like waves, similar to familiar tunes or songs or similar to sounds made by crickets, locusts and tree frogs. Even without any external background noises or with very loud ones the sounds may still be heard by patients.

The main problem of tinnitus is the nuisance or distress created although it is not a serious symptom. Around 36 million people in the United States have the disorder. Tinnitus is a symptom that arises from ear damage or other underlying ear problems. It can occur in any of the four ear regions namely the outer ear, middle ear, inner ear and brain. Mild tinnitus is normal which is perceivable in very quiet places.

There are also a number of causes such as damage to inner ear nerves, old age, loud noise exposure, middle ear bones or ear drum disease, ear infection, fluid imbalance, Meniere’s Disease, acoustic shock, aneurysm, brain tumor, acoustic neuroma and many others.

13.2. TREATING TINNITUS

There is no universal treatment approach for tinnitus although the main thrust aims toward alleviating the fight or flight response of the sympathetic nervous system. Examples of treatment may be gamma knife radiosurgery for the presence of tumors, medications like propranolol, clonazepam, lidocaine, tricyclic antidepressants, carbemazepine, anticonvulsants, benzodiazepines, avoidance of alcohol, nicotine, salt and caffeine, consumption of zinc, melatonin, sertraline, lipflavonoids, acamprosate and etidronate and other vitamins.

Other treatable causative factors for the condition like allergy, infection and earwax buildup may also be targeted in order to alleviate tinnitus. Some forms of surgery may be done but are not fully effective. Patients may also undergo methods and retraining techniques that help mask the ringing sound.

There are cognitive therapy and Tinnitus Retraining Therapy as well. Hypnosis, biofeedback, herbal medications like ginkgo, acupuncture, electrical stimulation, cochlear implants and hyperbaric oxygen chamber may also be used to treat the condition and results may vary depending on the underlying causes and response of the patient. Affected individuals may also undergo psychotherapy and counseling to help deal with the long-term effects.

13.3. PATIENT RESPONSE AND PROGNOSIS

It is possible for tinnitus to get better over time but this may not mean that the ear has returned to optimum condition. Ear damage is permanent and irreversible so the improvement may be due to the adjustments made by the patient in order to cope. Patients can help themselves by learning how to mask the noise with the use of soft sounds from fans and radios. They should avoid irritants like alcohol and caffeine and stick to a sound diet. Hearing aids can also help make external noise seem louder which also masks the ringing noise. Stress management is also useful for providing relief.

The prognosis of tinnitus depends on the underlying factors as well as the personal response of the individual to the distressing effects. Severe causes may result in long term or permanent tinnitus while other mild and treatable conditions may eliminate the problem altogether. Tinnitus does not really lead to more serious complications although the disease where it comes from may progress later on. Majority of patients do not find the nuisance a serious problem although 5% report feeling stressed most of the time.

14. COMMUNICATION AND HEARING LOSS

Due to the large numbers of people all over the world afflicted with ear problems resulting in hearing difficulty or loss, technological experts have developed some communication tools for assistance. These gadgets may be applicable to other tools as well like telephones, cellular phones and many others with the aim of helping patients cope with their condition.

14.1. COMMUNICATION CHOICES

Individuals suffering from hearing difficulty or loss due to ear problems and other underlying diseases may try a variety of approaches like learning sign language, writing notes when communicating, undergoing therapy to understand audible sounds and speech, medications or surgery. All these may help reduce or totally eliminate the problem. The rise of technological devices like hearing aids has also been very helpful during the coping process.

Millions of people are relying on hi-tech gadgets to improve their hearing. Some communication devices have also been improved to specifically cater to aurally incapacitated individuals such as assistive listening devices (ALDs). The tool recommended for patients may depend on several factors like severity of the disease or condition causing hearing problems, extent of hearing problem, ability of patients to cope through other means of communication and the presence of a support system during rehabilitation like family.

14.2. THE COMMUNICATION DEVICES

Telephone communication can be significantly improved for people with hearing loss in four ways. The first and most basic method would be to ensure that the volume is loud enough for the patient to hear and understand. Increasing the volume and adjusting the frequency can be done to boost voice clarity.

There are volume-enhancing tools that can easily be fitted on a standard telephone. The second method uses amplification technology wherein a gadget is attached to the telephone providing amplification options for the patient to improve hearing.

The third method uses T-coil technology wherein a T-coil ready hearing aid is paired with a compatible telephone resulting to clearer incoming voice.

The fourth and final method is to use a teletypewriter or TTY or TDD that stands for telecommunications device for the deaf. The device has an electronic display and keyboard wherein typed messages are instantly converted to electronic tones. The tones are then sent to the hearing impaired individual like a fax machine.

As for cellular phones, an earpiece or receiver may be attached to the external part of a hearing aid if the patient has one. Voice is then amplified through the close connection. Amplification technology can still be used and affixed to headsets since some wireless models may be roughly designed wherein it is almost impossible to have the mouthpiece stay close to the mouth as the earpiece reaches behind the ear. Text messaging features on cellular phones are also a reliable method that has the same approach as a TDD.

Fax machines have been equipped with direct-dialing options so that patients do not have to listen for a dial tone before activating the start button for sending or receiving documents.

14.3. MORE DEVICES

Interpretive devices are available which prove to be quite useful especially for those who have experienced being deaf for a short while and have adjusted in the smallest sense. There are different types of ALDs or assistive listening devices using either FM radio frequency or infrared or induction loop technology. The process of the system involves the other person speaking into a transmitter or microphone while the patient uses a T-switch located on his or her hearing aid. There may also be a specific receiver for a certain preferred ALD.

Computers may also help patients such as the process of computer-assisted note taking or CAN wherein any form of conversation is inputted into a computer then projected onto a screen for the patient to view and read text. The information given through CAN may not be word-for-word although the main idea is very accurate.

Computer-assisted real-time transcription or CART involves a computer with an attached stenographic keyboard. A unique software is installed into the computer allowing phonetic symbols to be translated into English or another understandable language. The texts are still viewed and read on a screen but the difference

is that the information given is word-for-word. CART is comparably more expensive than CAN too and requires a skilled operator.

15. COCHLEAR IMPLANTS

15.1. WHAT ARE COCHLEAR IMPLANTS AND WHO IS A CANDIDATE?

With the rise of technology and its dedication to electronics, individuals with impaired hearing have now found a way to cope for the long term. Cochlear implants are becoming more common as thousands of people worldwide have acknowledged its efficacy and convenience. There are some details to consider first however, determining if a person should have them or not.

15.2. DESCRIBING COCHLEAR IMPLANTS

A cochlear implant or CI is an electronic device surgically implanted in individuals suffering from hearing problems or loss. The device is very complex allowing affected persons to have a new sense of sound thereby earning itself the name “bionic ear”. It directly stimulates any available working auditory nerves located inside the cochlea through electronic impulses that is different to conventional hearing aids that only amplify sound. The device may be adjusted by patients to improve sound quality and volume.

Around 100,000 people all around the world have had cochlear implants. Half of these are adults while the rest are children. Implants may be made on one ear (unilateral) or both ears (bilateral). There are various types of cochlear implant devices but overall consist of the same parts. The first part has a receiver-stimulator which receives, decodes and sends electrical signals to the brain while the second part is an external device which has a microphone or receiver, speech processor and antenna which receives the sound, converts it into an electrical signal then sends it to the internal part of the cochlear implant. The internal device is surgically positioned under the skin while the external device is placed behind the ear.

15.3. HOW IT WORKS

A cochlear has 4 parts. The microphone is responsible for perceiving sound from the external environment. The speech processor chooses and organizes sounds perceived by the microphone. The transmitter and receiver/stimulator gets organized signals from the speech processor then converts these into electrical impulses. The electrode array composed of up to 22 electrodes collects the electrical impulses from the stimulator then transmits these to various regions of the auditory nerve. The resulting effect would be representation of sounds and not full hearing restoration. The person would then understand speech and perceive other external noises.

15.4. CANDIDATES FOR IMPLANTS

Children and adults who have severe hearing problems or are deaf can be qualified for cochlear implants. The Food and Drug Administration or FDA has approved regulation of the device as long as thorough examination and assessment has been done rendering the procedure safe and useful.

Patients' hearing history, underlying causes of hearing problems or loss, physical condition, support system for aural rehabilitation, speech recognition ability and amount of residual hearing are taken into consideration when determining candidates.

Candidates may be described as individuals who have good communication skills with family willing to support development of coping skills and a functioning auditory nerve. The patient should be fit for surgery, positive about the results and have contact persons to help during post-cochlear implant period such as a deaf educator and verbal therapist. It will also be helpful if the person experienced at least a short period of time dealing with hearing loss independently.

15.5. THE PROCEDURE

Cochlear implant surgery is done with the use of general anesthesia lasting around 2 to 3 hours. It may be done as an outpatient or require hospital stay for a few days depending on the patient's condition and type of device used. An incision is made behind the ear to expose the mastoid bone that leads to the middle ear. The mastoid bone is then opened with the use of a microscope and bone drill after which the internal device of the implant will be inserted.

The electrode array is placed into the inner ear or cochlea while the receiver is placed behind the ear in an artificial well. The two devices should be close enough to allow proper transmission of electrical impulses. The incision will then be stitched back together. After 3 to 4 weeks, the external device will be placed which is enough time for the wound to heal. Cochlear implants including post-surgery evaluation and rehabilitation may cost anywhere around $40,000. Once everything is fully healed, patients may be restricted from full-contact sports and MRI scans to prevent trauma and damage.