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## **PATIENT INFORMATION SHEET**

# **HOW THE EAR WORKS**

Welcome to the practice of Dr Zoran Becvarovski, specialising in ear, balance, facial nerve, nose and throat disorders. Dr Becvarovski is committed to providing you with the highest quality diagnostic and surgical treatment possible.

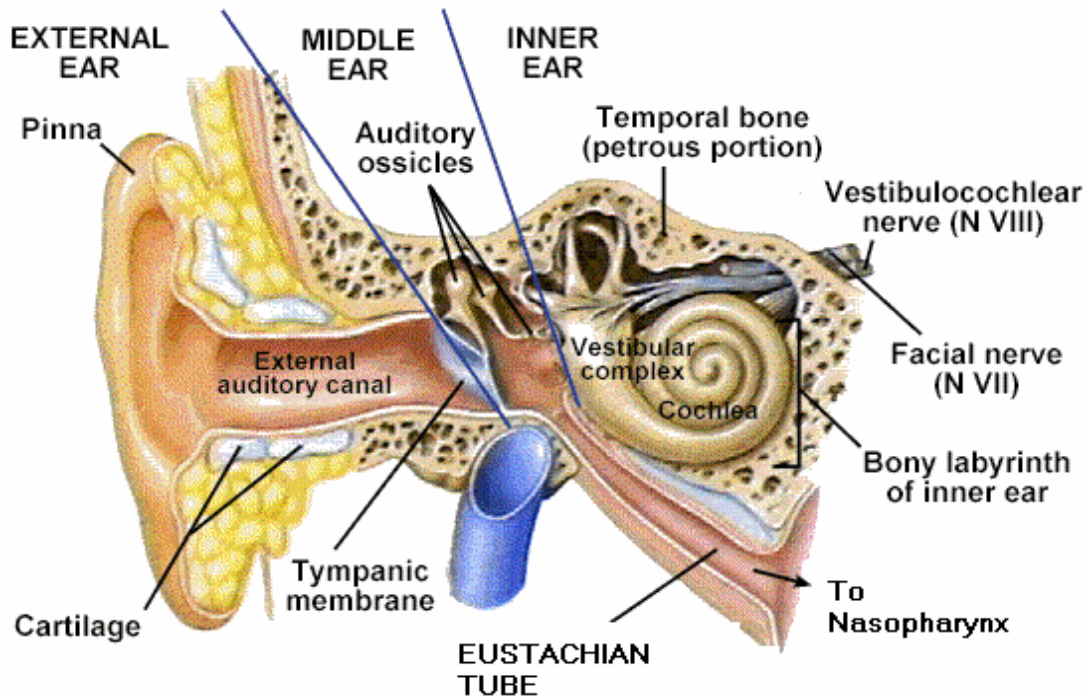
It is our privilege to be able to provide care for your medical problems and we will strive to make your visit to Dr Becvarovski's practice a positive and rewarding experience.

## **NORMAL STRUCTURE AND FUNCTION**

The human ear is a sensitive, complex organ that is divided into three parts: external, middle and inner ear. The external ear has two sections, the pinna and the auditory canal. The pinna is the visible part of the ear that's attached to the side of your head. Its folds and creases are used to gather and enhance sound waves and guide them into the auditory canal toward the eardrum. The eardrum, also known as the tympanic membrane, located on the outside wall of the middle ear.

The middle ear is an air-filled cavity which lies between the external and inner ear. It contains the three bones of hearing: malleus (hammer), incus (anvil), and stapes (stirrup). The eardrum and these bones transmit sound vibrations to the inner ear. The middle ear cavity is connected to the back of the nose (near the adenoids) via the Eustachian tube which acts as a pressure equalising valve. The air in the middle ear is continually being absorbed into the bloodstream, thus if normal pressure is to be maintained, this air must be replaced. Consequently a normal Eustachian tube will open momentarily every time we swallow to allow a small amount of air into the middle ear. An abnormality of the outer or middle ear may lead to a conductive hearing loss, which may be correctable surgically or medically.

The inner ear consists of the cochlea (for hearing) and the semicircular canals (for balance). The inner ear is filled with fluid which bathes delicate nerve endings. These nerve endings transmit sound energy to the brain. An abnormality of the inner ear may result in a sensorineural (nerve) hearing loss which is usually not correctable.



## HOW WE HEAR

Sounds enter the outer ear via the *pinnae* and *external auditory canal* and strike the *tympanic membrane* causing it to vibrate. This vibration is passed along the three bones of the middle ear. The last of these bones, the *stapes*, sits in a small niche called the *oval window* connected to the inner ear. The vibrations of the stapes makes fluid in the inner ear move and stimulates the nerve endings in the organ of Corti (often referred to as the end organ of hearing) where the processing actually begins. The stimulated nerves send their signal along the hearing nerve to the hearing centres of the brain. At different junctions of the hearing nerve processing takes place and the signal is passed to the hearing centres in the brain where further processing and decoding takes place and we "hear".

The process described above is a gross explanation of what happens in the hearing system. Remember, the entire process occurs in both ears and the hearing centres in the brain receive information from both ears.

## CAUSES OF HEARING LOSS

There are many conditions that can cause hearing loss. The following are some of the more common causes.

### A. Outer Ear

1. Build up of earwax (cerumen).
2. Infection (otitis externa or "swimmers' ear") This can cause swelling, pain, itching and rawness of the ear canal
3. Narrowing of the ear canal
4. Foreign body

### B. Middle Ear

1. A hole (perforation) of the eardrum
2. Infection of the middle ear (otitis media) causing middle ear fluid build-up
3. Cyst (cholesteatoma) blocking movement of the ear bones
4. Otosclerosis: This condition prevents movement of the stapes bone. It is caused by excessive bone growth around the stapes
5. Injuries to the head which damage or disconnect the middle ear bones
6. Improper development or fixation of the middle ear bones

### C. Inner Ear

1. The aging process may cause a gradual decline in hearing. This is known as presbycusis
2. Sudden or prolonged exposure to very loud sounds such as the firing of a gun, or exposure to 'rock' concert music
3. Gradual exposure (over months or years) to damaging, but less intense sounds such as factory noise, or continued use of portable radios
4. Congenital or hereditary hearing loss
5. Illness with very high fevers
6. Injuries to the head which damage the inner ear, hearing nerve or brain
7. Rarely, brain tumours may damage the hearing nerve

## TREATMENT OF HEARING LOSS

### Conductive Hearing Loss

This type of loss is due to an outer ear or middle ear problem. The following is a list of the more common causes of conductive hearing loss with treatment options. **(In bold face)**

#### A. Outer ear

1. Ear wax (**Removal by a physician**)
2. Otitis externa or "swimmers' ear" (**Antibiotic ear drops**)
3. A birth defect of the ear canal (**Surgical widening of the ear canal**)

#### B. Middle ear

1. A hole or perforation of the eardrum (**Surgical repair**)
2. Otitis media (**Antibiotics or placement of a small tube in the eardrum**)
3. Cyst or cholesteatoma (**Surgical removal**)
4. Otosclerosis (**Surgical replacement of the stapes bone with a prosthesis and/or of a hearing aid**)
5. Injuries to the head which damage or disconnect the middle ear bone(s) (**Replacement of the ear bone(s) with a prosthesis**)

### Sensorineural or "Nerve" Hearing loss

This type of loss is due to an inner ear or hearing nerve problem and is best treated with a hearing aid.

In patients who are totally deaf, a cochlear implant is a possible treatment option. A cochlear implant is an electronic device which is surgically implanted into the inner ear. It bypasses damaged parts of the inner ear and electronically stimulates the hearing nerve.

### Mixed Hearing Loss

This type of hearing loss is a combination of a conductive and a sensorineural hearing loss. Treatment depends on the severity of the conductive and sensorineural portions of the hearing loss.

## BALANCE:

Movements of the head, either forward, back, or side to side, causes subsequent movement of fluid in the balance chamber. This information is then sent to the brain along the balance (vestibular) nerve as an electrical impulse and are interpreted as the sensation of motion.