AUDIO AND VISUAL EQUIPMENTS

3.1 AUDIOMETER

Audiometer is an instrument used in measuring the acuity of hearing. They usually consist of an embedded hardware unit connected to a pair of headphones.

They are most commonly used in hospitals, audiology centers and research communities. These audiometers are also used to conduct industrial audiometric testing. It also measures the ability to discriminate between different sound intensities, recognize pitch, or distinguish speech from background noise.

There are three main types of audiometrical procedures:

Pure tone audiometry

Speech audiometry

Screening audiometry

Pure tone audiometry

This procedure uses an audiometer (an instrument for recording the intensity of sound heard by the patient) to determine the extent of hearing loss.

The patient is made to hear pure tones (musical or non-musical) of varying frequencies and intensities.

There may be high-pitched sounds played at frequent intervals and the patients response to these are noted. The site of hearing loss can also be determined by the readings on the audiogram.

They are given by air conduction by an earmuff, and by a probe put on the bone behind the ear. The patient is seated in a quiet testing chamber and made to wear earphones.

Each ear is tested separately. The sounds begin with the lowest frequency that is increased till the person is able to hear the sound. The patient indicates as such by raising a hand, and the audiometer reading is noted.

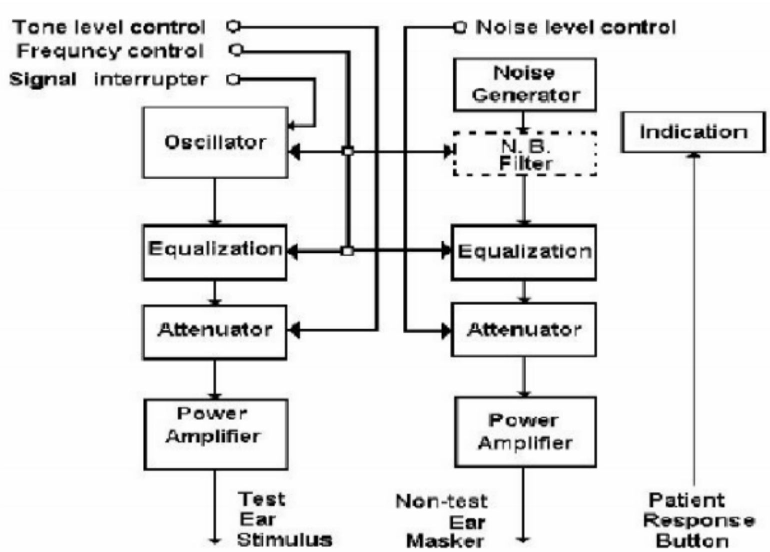
Speech audiometry

The procedure being essentially the same, speech audiometry utilises human speech instead of pure tones for testing.

The test measures patient's ability to hear a sentence (sensitivity) and to distinguish intelligible speech sounds. The examiner asks the patient to repeat whatever is said to him and then determines the extent and area of hearing loss.

Unlike the clinical speech- hearing assessment, a definite number of words, for a set protocol are used, and the percentage of words understood is noted, and the lowest intensity to understand a set percentage is noted.

This helps in differentiating between hearing loss caused due to damage in the hearing organ, and the hearing nerve.



HEARING AIDS

A hearing aid or deaf aid is an electroacoustic device which is designed to amplify sound for the wearer, usually with the aim of making speech more intelligible, and to correct impaired hearing as measured by audiometry.

Parts of Hearing Aids

Hearing aids are fairly simple devices, consisting of four basic parts:

A microphone picks up sound from the environment and converts it into an electrical signal, which it sends to the amplifier.

An amplifier increases the volume of the sound and sends it to the receiver.

A receiver/speaker changes the electrical signal back into sound and sends it into the ear. Then those impulses are sent to the brain.

A battery provides power to the hearing aid.

Types of hearing Aids

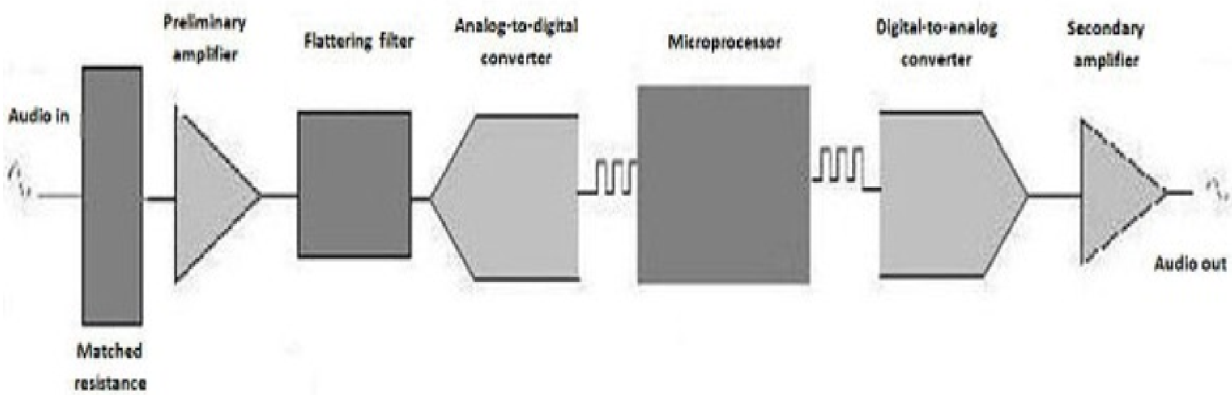
In the ear (ITE): This large hearing aid works well for people with mild to severe hearing loss. It fits completely in the bowl of the ear. Because it is so large, the ITE hearing aid is among the most visible of styles, but the battery lasts longer than in smaller aids, and it can accommodate directional microphones.

In the canal (ITC): The ITC hearing aid works only for mild to moderate hearing loss. It is customized to fit the size and shape of the person's ear canal. Although this hearing aid is inconspicuous, its small size makes it difficult to adjust and change the battery.

Behind the ear (BTE): The BTE hearing aid can help with all types of hearing loss, from mild to profound. The electronics are in a case that sits just behind the ear. The case connects by a piece of clear tubing to a plastic piece called an earmold, which sits inside the ear. Sound travels from the earmold into the ear.

Most hearing aids use zinc-air cells, which are powered by oxygen, but a few use mercury batteries.

Analog – This is the original way of transmitting sound. In analog transmission, the signal travels from one media to another without changing shape. The sound waves picked up by the microphone are the same as the signal that is transferred by the hair cells, just electronic and amplified. Analog hearing aids come preprogrammed according to directions provided by your audiologist. In addition, your audiologist can adjust and re-program your analog hearing aid. Because this technology allows for various programs, you can have different programs for different hearing environments. Analog technology is less expensive than digital technology.



Digital – The majority of modern hearing aids are digital. Digital devices take the sound signal picked up by the microphone and break it down into binary code before it gets to the amplifier. This binary code is the same series of 1s and 0s that are used in computer communication. What makes digital transmission of data so great is that in addition to transmitting the data, digital can include information about the original transmission. This information helps to detect errors in transmission. Also, the use of digital transmission allows the device to be programmed to act in a specific manner for certain pitches or tones. These devices are also programmable by your audiologist to fit your exact needs, which makes them great when hearing loss is not consistent across all frequencies.

SPIROMETRY

Spirometry is the most common of the lung function tests. These tests look at how well your lungs work. Spirometry shows how well you breathe in and out. Breathing in and out can be affected by lung diseases such as chronic obstructive pulmonary disease (COPD), asthma, pulmonary fibrosis and cystic fibrosis. Spirometry is the name of the test, whilst a spirometer is the device that is used to make the measurements.

A spirometer measures ventilation, the movement of air into and out of the lungs. The spirogram will identify two different types of abnormal ventilation patterns, obstructive and restrictive. There are various types of spirometers which use a number of different methods for measurement

Procedure

You need to breathe into the spirometer machine. First you breathe in fully and then seal your lips around the mouthpiece of the spirometer. You then blow out as fast and as far as you can until your lungs are completely empty. This can take several seconds. You may also be asked to breathe in fully and then breathe out slowly as far as you can. A clip may be put on to your nose to make sure that no air escapes from your nose. The measurements may be repeated two or three times to check that the readings are much the same each time you blow into the machine.

Spirometry measures the amount (volume) and/or speed (flow) of air that can be inhaled and exhaled. The most common measurements used are:

Forced expiratory volume in one second (FEV1). This is the amount of air you can blow out within one second.

Forced vital capacity (FVC). The total amount of air that you blow out in one breath.

FEV1 divided by FVC (FEV1/FVC). Of the total amount of air that you can blow out in one breath, this is the proportion that you can blow out in one second.

A spirometry reading usually shows one of four main patterns:

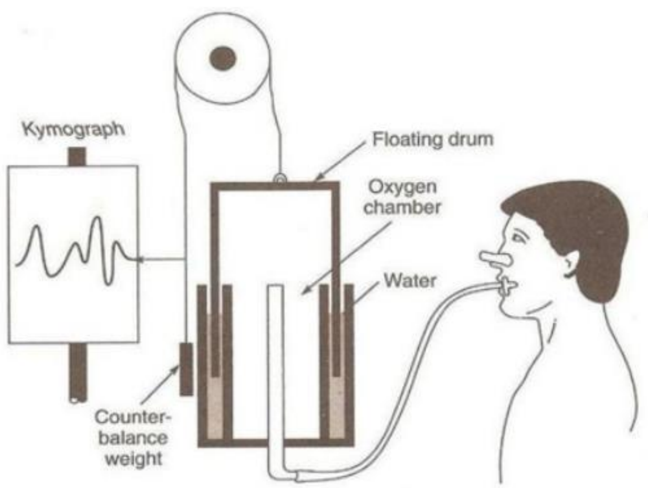
Normal.

An obstructive pattern- This is typical of diseases that cause narrowed airways. The main conditions that cause narrowing of the airways and an obstructive pattern of spirometry are asthma and COPD.

A restrictive pattern - This is caused by various conditions that affect the lung tissue itself, or affect the capacity of the lungs to expand and hold a normal amount of air. Conditions that cause fibrosis or scarring of the lungs give restrictive patterns on spirometry.

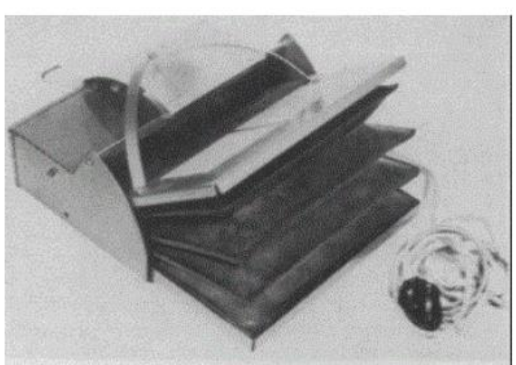
A combined obstructive/restrictive pattern- asthma plus another lung disorder. Also, some lung conditions have features of both an obstructive and restrictive pattern. An example is cystic fibrosis where there is a lot of mucus in the airways, which causes narrowed airways (the obstructive part of the spirometry results), and damage to the lung tissue may also occur.

Water sealed spirometer



The water-seal spirometer is a counterweighted bell inverted into a water reservoir; the bell rises and falls as the patient breathes. Its motion moves either a transducer or a pen that records volume data on calibrated chart paper mounted on a rotating drum (kymograph). The low-friction water seal and counterweight limit resistance and back pressure so that the measurement itself does not adversely affect the patient's response.

Wedge Spirometer



A waterless spirometer constructed of two large rectangular plates with edges connected by accordion-pleated rubber so that large changes in volume are accommodated by small changes in the acute angle of the wedge-shaped interior, sensed by an electrical transducer; designed to record rapid changes in respiratory function.

TEST CHART STANDARD

An eye chart is a chart used to measure visual acuity. Eye charts are often used by health care professionals, such as physicians or nurses, to screen persons for vision impairment. Ophthalmologists, physicians who specialize in the eye, also use eye charts to monitor the visual acuity of their patients in response to various therapies such as medications or surgery.

Snellen Chart

A Snellen chart is an eye chart that can be used to measure visual acuity. Snellen charts are named after the Dutch ophthalmologist Herman Snellen who developed the chart in 1862.

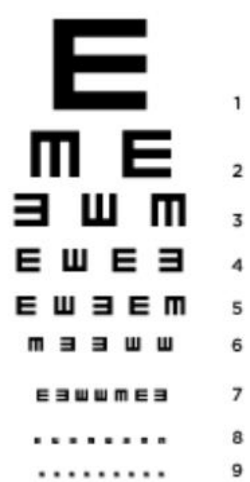
The common Snellen chart is printed with eleven lines of block letters. The first line consists of one very large letter, which may be one of several letters, for example E, H, or N. Subsequent rows have increasing numbers of letters that decrease in size. A person taking the test covers one eye from 6 metres or 20 feet away, and reads aloud the letters of each row, beginning at the top.

The smallest row that can be read accurately indicates the visual acuity in that specific eye. The symbols on an acuity chart are formally known as "optotypes". In the case of the traditional Snellen chart, the optotypes have the appearance of block letters, and are intended to be seen and read as letters. They are not, however, letters from any ordinary typographer's font. They have a particular, simple geometry in which:the thickness of the lines equals the thickness of the white spaces between lines and the thickness of the gap in the letter "C",the height and width of the optotype (letter) is five times the thickness of the line.

The "Tumbling E" Eye Chart

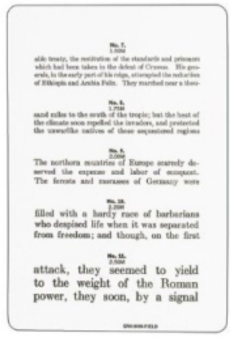
In some cases a standard Snellen eye chart cannot be used. One example is when the person having the eye test is a young child who doesn't know the alphabet or is too shy to read letters aloud. Other examples include when the person is illiterate or has a handicap that makes it impossible for him to cognitively recognize letters or read them aloud.

In these situations, a modification of the Snellen eye chart called a "tumbling E" chart may be used. The tumbling E chart has the same scale as a standard Snellen eye chart, but all characters on the chart are a capital letter "E," in different spatial orientations (rotated in increments of 90 degrees).



The eye doctor asks the person being tested to use either hand (with their fingers extended) to show which direction the "fingers" of the E are pointing: right, left, up or down.

The Jaeger Eye Chart



To evaluate your near vision, your eye doctor may use a small hand-held card called a Jaeger eye chart. The Jaeger chart consists of short blocks of text in various type sizes. The Jaeger chart is an eye chart used in testing near vision acuity. It is a card on which paragraphs of text are printed, with the text sizes increasing from 0.37mm to 2.5mm.[1] This card is to be held by a patient at a fixed distance from the eye dependant on the J size being read. The smallest print that the patient can read determines their visual acuity.