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CLINICAL EXAMINATION AND DIAGNOSIS IN OTORHINOLARYNGOLOGY

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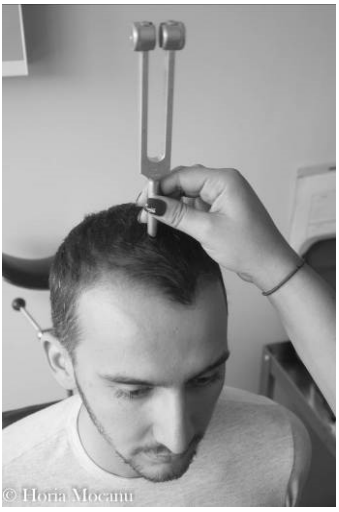
II.10. WEBER TEST
(TUNING FORK TESTS)

Necessary instruments: Tuning fork (frequency 250 Hz, 440 Hz or 512 Hz.)

To examine: Conductive hypoacusis vs. Sensorineural hypoacusis (orientation tests). – **Figure 11**

Vibrate the tuning fork by hitting it against your patella.	
Place the stem of the tuning fork on the vertex. Ask patient to report in which ear the sound is heard louder. **Attention!** – do not touch the prongs of the tuning fork	

<table>
<tr><td>The tuning fork can also be placed on the forehead (glabella) or on the nasion...</td><td>  </td></tr>
<tr><td>...or on the menton.</td><td>  </td></tr>
<tr><td>Normal aspects:
• Normal Weber test (equal sound in both ears or the patient cannot localize the sound).

Normal hearing or symmetrical bilateral hypoacusis.</td><td>Pathological aspects:
• Sound heard best in the abnormal ear → Conductive hearing loss.

• Sound heard best in the normal ear → Sensorineural hearing loss.</td></tr>
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!!! Frequent mistakes:

- Do not hit the tuning fork against hard surfaces (furniture) or you will decalibrate it.
- If the stem of the tuning fork is not in direct contact to the cranium, the sound will not be heard.
- Do not touch the prongs of the tuning fork. Hold it by the stem only.

THEORETICAL ASPECTS

Sound transmission **(Figure 12):**

- *Air conduction (AC):* the sound wave is collected by the ear pavilion, funneled through the external ear canal (EAC) and sets the tympanic membrane and the ossicular chain in motion. The stapes footplate rocks back and forth and impinges upon the oval window and sets the perilymph of the inner ear in motion. The movement of the liquids within the inner ear stimulates the hair cells and generates an electrical impulse through the auditory nerve, which will be decoded in the brain, as sound information. This is the mechanism which explains hearing the tuning fork in front of the EAC when performing the *Rinné test.*
- *Bone conduction (BC):* the sound wave sets the skull bones in motion and this vibration is transmitted directly or indirectly to the inner ear. This is the mechanism which explains hearing the tuning fork when it is in contact to bony prominence of the skull in both *Weber* and *Rinné tests.*

Attention! – Air conduction is always more efficient than bone conduction (AC>BC) because air is a much lower density transmission medium (lower resistance means less energy required for the same result).

Hypoacusis – hearing loss. Depending on the mechanism, it is classified as: conductive, sensorineural and mixed.

Conductive hearing loss: generated by impaired air conduction (EAC – TM – ossicular chain), or in other words, pathology of the *external* or *middle ear*, such as:

- EAC stenosis,
- Foreign bodies in the EAC (most frequently cerumen),
- Acute inflammation (otitis externa),

- TM perforation,
- Ossicular chain afflictions,
- Liquid build up in the middle ear (catarrhal otitis media, suppurated otitis media, Eustachian tube disfunction).

This type of hearing loss makes the patient hear his own voice louder (autophony) which makes him speak lower. In order to understand the phenomena, try covering both your EAC with your fingers and speak. Conductive hearing loss is never lower than 60 dB.

Sensorineural hearing loss: generated by pathology of the inner ear (cochlea), vestibulocochlear nerve (VIII) or hearing areas within the brain. It is characterized by impairment of the bone conduction. Usual causes include:

- Vascular pathology,
- Ménière's disease,
- Sound trauma,
- Sudden deafness,
- Presbycusis (age related hearing loss),
- Ototoxicity (ear afflictions by various substances),
- Inner ear trauma,
- Neurolabirintitis (inflammation of the inner ear and acoustic nerve),
- Tumors of the vestibulocochlear nerve.

In this type of hypoacusis the patient hears his own voice lower and therefore tends to speak louder. The patient may also say that he hears people talk but he does not understand the words or that he does not hear high pitched sounds very well (door-bell, telephone). Children born with this type of hearing loss or those who acquire it in early childhood have major difficulties in developing language and may become deaf-mute.

Mixed hypoacusis means impairment of both mechanism (*AC* and *BC*) at the same time for the same ear.

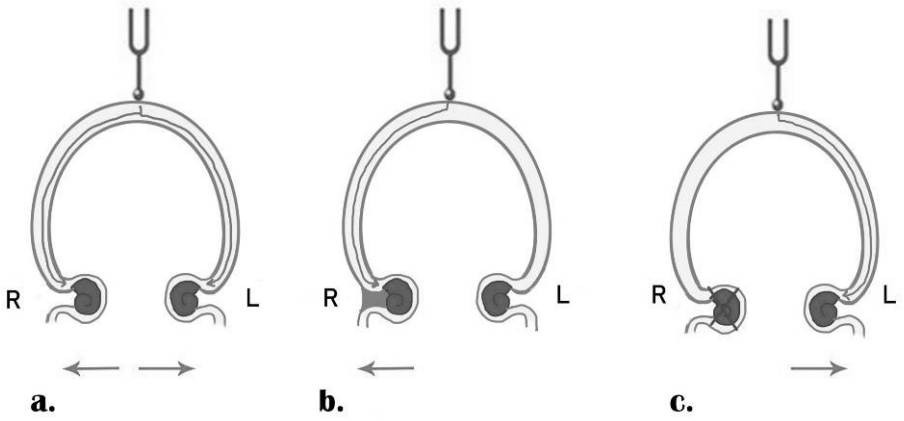

Figure 11 – Weber Test (comparing BC of the two ears).

a. *Equal sound in both ears* → **Normal hearing or symmetrical bilateral hypoacusis.** Sound is transmitted equally via BC in both ears and directed externally through the middle and external ear.

b. *Sound heard best in the abnormal ear* → **Conductive hearing loss** (affliction of the AC). Sound is transmitted equally via BC in both ears and directed externally through the middle and external ear. In the afflicted ear these waves hit an obstruction and are redirected to the inner ear creating the sensation of louder sounds. Another theory suggests that external sounds can no longer reach the inner ear through an impaired external or middle ear and therefore BC is perceived louder.

c. *Sound heard best in the normal ear* → **Sensorineural hearing loss** (affliction of the BC). Sound is perceived less through BC on the side of the afflicted cochlea.

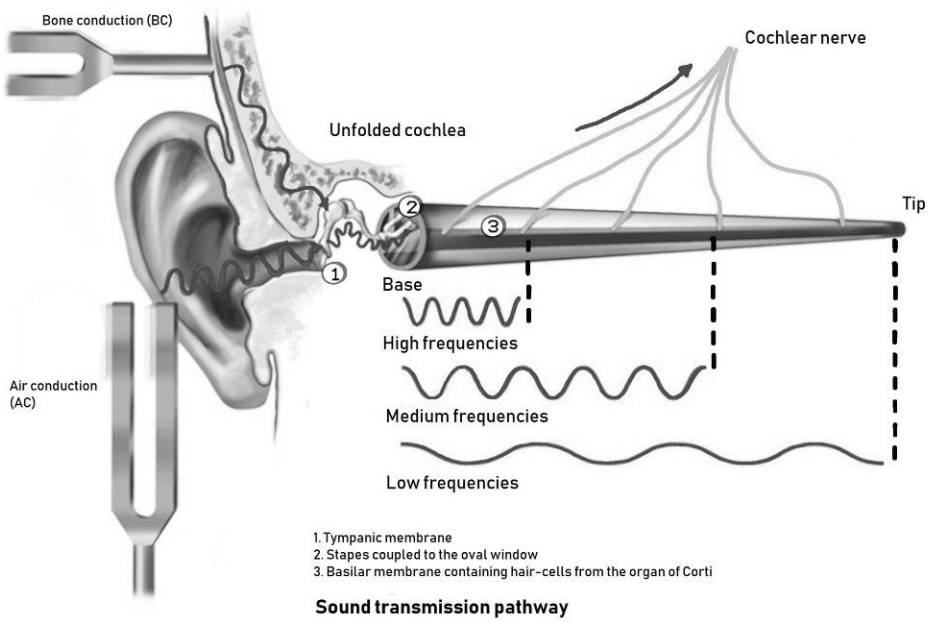

Figure 12 – Sound transmission pathways (AC and BC).