**Expert Review** Examination of the Ear Using the Tuning Fork Tests

Tom GH Bowden* and Martin J Burton#

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**Abstract** The tuning fork tests provide a reliable clinical method for assessing the nature of a patient's hearing loss. They require minimal equipment, and are simple to perform. This review provides a routine for performing Rinne's and Weber's tests. It follows the principles of clinical examination [1] and should provide a useful resource for the both novice medical student and the more experienced clinician who may be required to perform these tests.

**Key Words:** tuning fork, Rinne, Weber.

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**Introduction**

The tuning fork tests provide a reliable clinical method for assessing the nature of a patient's hearing loss. They are most useful in patients with unilateral hearing loss which is purely conductive or purely sensorineural. Patients with bilateral loss or mixed losses are better assessed with formal pure tone audiometry. These tests should be carried out in a full examination of the cranial nerves or the ear. However, as they do not fall neatly into either category we will consider them separately here.

The two tests we will consider here are Rinne's test and Weber's test. Other tuning fork tests include the Schwabach and Bing tests, though these are not used in routine practice. The Rinne and Weber tests both require a skilled examiner and a basic understanding of the patho-physiology of hearing and hearing loss. These tests help distinguish between a conductive hearing loss (CHL) and sensorineural Hearing Loss (SHL), and identify a patient with a totally ‘dead’ ear.

**Examination**

As for all clinical examinations, we aim here to follow the Principles of Clinical Examination [1]. Equipment needed for this test is a 512 Hz [2] tuning fork. Start by introducing yourself to the patient, asking their permission to examine them and explain what you are going to do. They should be seated in a quiet room for these tests to be performed properly.

**Weber's Test**

To perform Weber's test strike the fork against your knee or elbow. Then place the base of the fork in the midline, high on the patient's forehead (Figure 1). It is important to steady the patient's head with your other hand so that reasonably firm pressure can be applied. Then ask the patient if the patient hears the sound and if so, is it louder in one ear or the other, and if so which? If the patient is unclear, you may ask if they hear it “everywhere.” Be careful not to ask the question in a leading manner. In normal hearing the sound should be heard equally in both ears. In many patients they report this as being heard “everywhere” or in the middle of the head. If the sound lateralises to one ear then you need to work out whether it is due to a sensorineural or a conductive hearing loss. Knowing which ear has the hearing loss makes this straightforward.

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Figure 1  Weber's Test.
Interpretation
Weber’s test will ‘lateralise’, i.e. move to one side, with a relatively small amount of hearing loss (5dB). In cases of unilateral hearing loss, only 70% of patients will report that the sound has lateralised and of these 25% will refer it to the incorrect ear [3]. If a patient has a conductive cause of unilateral deafness, the tuning fork will ‘lateralise’ to the deaf ear. Recall that in unilateral conductive hearing loss the sound will lateralise to the ear with conductive loss. If a patient has a sensorineural cause of the unilateral deafness, the tuning fork will lateralise to the good ear. Recall again that in unilateral sensorineural loss the sound will lateralise to the normal ear. In bilateral and symmetrical hearing loss of either type Weber’s test will be normal. The various outcomes of the different tests are shown below in Table 1.

Rinne’s Test
This test aims to compare air conduction with bone conduction. This test is thought to have a high sensitivity (0.84) [4], though this varies with the skill of the examiner [5]. This variability may be due to the fact that it is an examination manoeuvre and a subjective rather than an objective test of hearing function. Rinne’s test can only detect a conductive hearing loss of at least 30dB [6].

Begin by striking the tuning fork against your knee or elbow. Hold the tuning fork in one hand and place the base against the patient’s mastoid process (Figure 2). Allow it to stay there for 2-3 seconds to allow them to appreciate the intensity of the sound. Then promptly lift the fork off the mastoid process and place the vibrating tips about 1cm from their external auditory meatus (Figure 3). Leave it there again for a few seconds before taking the tuning fork away from their ear. Then ask the patient in which of the positions they were able to hear the note the loudest. A patient who hears the fork loudest when it is held against the mastoid process has a negative Rinne’s test. One who hears it loudest when held 1cm from the external auditory meatus has a positive Rinne’s test.

Results of Rinne’s Test
In a normal ear sound is conducted to the cochlear most efficiently via air conduction. Sound can also be transmitted, less efficiently via bone, to the cochlea. Thus if a patient has a positive Rinne’s test it demonstrates that air conduction is better than bone conduction and they therefore do not have a significant conductive hearing loss. If Rinne’s test is negative, sound is transmitted more efficiently via bone than air, and this demonstrates a conductive hearing loss. In sensorineural hearing loss Rinne’s test should be positive.

There is a caveat to this, the false negative Rinne’s test. This can be found in total unilateral sensorineural hearing loss (i.e. a ‘dead’ ear). On testing bone conduction the sound travels to the good (i.e. untested) ear and sounds louder than when the fork is held next to the external auditory meatus on the side being tested – the patient reports that bone conduction is better than air conduction giving a false negative Rinne’s test. To complete your examination thank the patient.
When performing the tuning fork tests it is important to realise, as stated at the beginning, that results of tuning fork tests are not straightforward, nor particularly helpful in diagnosis, where patients have bilateral hearing loss of (a) different amounts, (b) different types or (c) mixed types.

<table>
<thead>
<tr>
<th>Test</th>
<th>Normal Conductive Hearing Loss</th>
<th>Sensorineural Hearing Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rinne's</td>
<td>AC &gt; BC (Rinne's Positive)</td>
<td>BC &gt; AC (Rinne's Negative)</td>
</tr>
<tr>
<td></td>
<td>AC &gt; BC * (Rinne's Positive)</td>
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<tr>
<td>Weber's</td>
<td>Sound heard in midline</td>
<td>Sound heard in affected ear</td>
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<tr>
<td></td>
<td>Sound heard in good ear</td>
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</tbody>
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Table 1 Interpretation of Rinne’s and Weber’s tests. * Unless total sensorineural hearing loss when a False Negative Rinne’s may occur.

References