



## Recommended Procedure

### Rinne and Weber tuning fork tests

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## General foreword

This document presents a Recommended Procedure by the British Society of Audiology (BSA). A Recommended Procedure provides a reference standard for the conduct of an audiological intervention that represents, to the best knowledge of the BSA, the evidence-base and consensus on good practice given the stated methodology and scope of the document and at the time of publication. This document supersedes any previous recommended procedure *for tuning fork tests* by the BSA (1987).

Although care has been taken in preparing the information supplied by the BSA, the BSA does not and cannot guarantee the interpretation and application of it. The BSA cannot be held responsible for any errors or omissions, and the BSA accepts no liability whatsoever for any loss or damage howsoever arising. This document supersedes any previous recommended procedure by the BSA and stands until superseded or withdrawn by the BSA.

Stakeholder consultation was undertaken in August 2016. The draft document was available via the BSA website. An electronic copy of this draft, the full list those invited to comment on the draft and the spreadsheet of comments supplied during the consultation are available on request.

Comments on this document are welcomed and should be sent to:

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## Contents

1.	Introduction.....	4
1.1	Background and scope.....	4
1.2	Development of the recommended procedure.....	4
2.	General considerations.....	4
2.1	The Tuning Fork.....	5
2.2	Striking the tuning fork.....	5
3.	Subject preparation.....	5
4.	Tuning Fork Tests.....	6
4.1	The Weber Test.....	6
4.1.1	Procedure.....	6
4.1.2	Response.....	6
4.1.3	Interpretation.....	7
4.2	The Rinne Test.....	7
4.2.1	Procedure.....	7
4.2.2	Response.....	8
4.2.3	Interpretation.....	8
5.	References.....	10
	Appendix A: Example test results.....	11





## 1. Introduction

### 1.1 Background and scope

The purpose of this document is to describe guiding principles for safe and effective tuning fork testing carried out in any audiological context, with both children and adults.

The term 'shall' is used in this document to refer to essential practice, and 'should' is used to refer to desirable practice.

This document describes a single method for the Rinne and Weber tuning fork tests which are simple to carry out. Implicit throughout this recommended procedure is that there is an acknowledgement that any tuning fork test provides only limited indications on the type of hearing loss present and only at the frequency of the tuning fork being used. It is no substitute for further audiological assessment. In a primary care setting it is suggested that tuning fork testing is effective only as part of a screening programme for hearing loss and should not be the sole indicator on which a decision for further audiological assessment is based.

Tuning forks are used as a simple and brief test to establish the probable presence or absence of a significant conductive element to hearing loss. They are typically used to provide early diagnostic information, when audiometry is not available or possible.

There are a number of different tuning fork tests in literature; the Rinne and Weber test are complementary to each other. For this recommended procedure, only the Weber and Rinne tests are described. They shall be undertaken together rather than as independent tests. Information on the sensitivity and specificity of these tests can be found on pages 7 and 8.

### 1.2 Development of the recommended procedure

Unless stated otherwise, the principles described here represent the consensus of expert opinion and received wisdom as interpreted by the Professional Guidance Group (formerly the Education Committee and the Professional Practice Committee of the British Society of Audiology) in consultation with its stakeholders. The document was developed in accordance with BSA guidance development protocols.

## 2. General considerations

The practitioner shall be competent, or supervised by someone who is competent, in tuning fork tests. Competence should be evidenced by sufficient and relevant training, experience and assessment.





## 2.1 The Tuning Fork

The preferred tuning fork is a 512Hz tuning fork. At this frequency the tone does not fade too quickly, producing limited overtones and is not vibrotactile in comparison to the 256Hz and 1024 Hz tuning forks. (Khanna et al, 1976 & Tonndorf, 1968).

When struck accurately the tuning fork should be heard with 40-50 dBHL of bone conduction hearing threshold levels. (Thiagarajan & Arjunan 2012).

## 2.2 Striking the Tuning Fork

Ensure you use a tuning fork designed for audiometric examination, which must include footplate and there should be no damage or chips to the tines prior to use. (Figure 1).

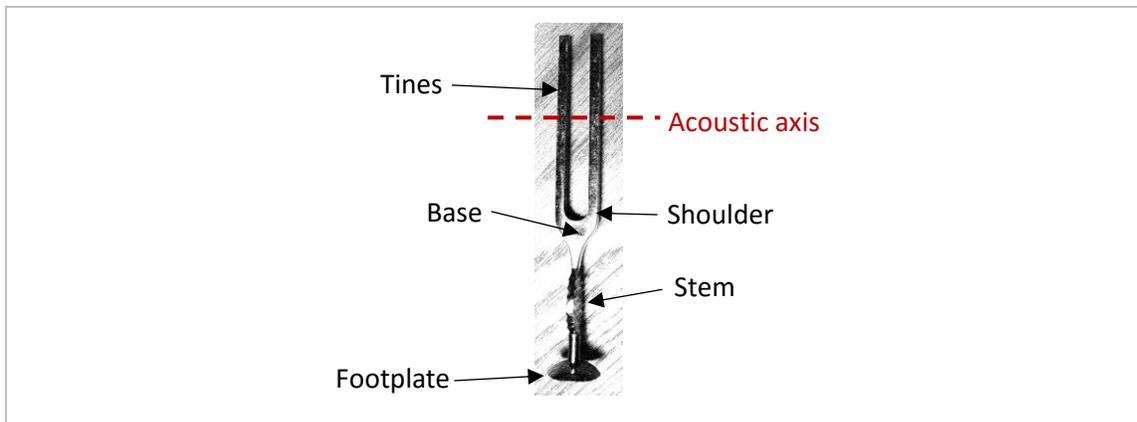


Figure 1 – The tuning fork

The practitioner shall hold the tuning fork by its stem and strike one side of the tines, two thirds of the way along the tine from the base on a padded surface or the practitioner's elbow or ball of hand. Do not strike it on a hard surface as this may damage the tuning fork and this will introduce harmonic overtones.

## 3. Subject preparation

The test should be undertaken in a quiet room.

The practitioner shall instruct the patient on each of the tests. Tuning fork tests are particularly subjective and response bias must be accounted for when determining their validity as diagnostic tools. Clear and concise instructions will limit misinterpretation by the patient.





When undertaking this test on young children it may be necessary to have the child sat on the parent's knee and the tuning fork should be held in plain sight. The practitioner may wish to prime the tuning fork and hold it on a surface so the sound can be heard to prepare the child for the test, it can also be helpful to get the child to close their eyes whilst they listen to help them concentrate.

## 4. The Tuning Fork Tests

The practitioner should start with the Weber test first as the results of this can influence missing a false Rinne negative.

### 4.1 The Weber Test

The Weber test is a test of lateralisation and establishes where a tone is perceived.

#### 4.1.1 Procedure

Strike the tuning fork and place it on the midline, typically on the patient's forehead, (but it can also go on the vertex, bridge of the nose or chin). Place your other hand gently, but firmly on the back of the patient's head to ensure enough counter-pressure is applied. Hold the tuning fork in place for up to 4 seconds. (Figure 2).

#### 4.1.2 Response

After giving the patient listening time ask them where the tone is heard: is it in both ears / centrally / in the head or towards the left or right.

Children may choose to point to the ear rather than giving a verbal response.



Figure 2 – Appropriate technique for the Weber test





### 4.1.3 Interpretation

1. With symmetrical hearing or a symmetrical hearing loss the sound should be central
2. With an asymmetrical sensorineural loss the sound should be heard in the better ear
3. With an asymmetrical conductive hearing loss the sound should be heard in the poorer ear

*Points to note:*

Thiagarajan & Arjunan (2012) suggest the Weber test can determine a difference of 5 decibels between each ear in terms of bone conduction thresholds at the frequency being tested. \*

This test can be complicated by the presence of a unilateral or asymmetrical conductive hearing loss, where the tone can be heard on the conductive side or the side with the greater conductive loss. Interpretation of the Weber test in isolation can be prone to error.

## 4.2 The Rinne Test

This test is a comparison of loudness of perceived air conduction to bone conduction in one ear at a time.

### 4.2.1 Procedure

The practitioner should start with the ear where the Weber has lateralised to (if appropriate).

Strike the tuning fork and hold the tines of the tuning fork approximately 25mm from the ear canal entrance. The vibrating fork should be held parallel to the acoustic axis (see figure 1 and figure 3). The orientation of the tuning fork is critical so ensure the acoustic axis is pointing towards the ear canal.

Hold the tuning fork there for about 2 seconds. (Figure 3). Without any interruption and without touching the tines press the footplate firmly against the mastoid (without any hair getting between the footplate and the mastoid). Place your other hand gently, but firmly on the opposite side of the patients head to ensure enough counter-pressure is applied. Hold the tuning fork in place for another 2 seconds. (Figure 4).





Figure 3 – Appropriate technique for the Rinne air conduction test



Figure 4 – Appropriate technique for the Rinne bone conduction test

#### 4.2.2 Response

After giving the patient listening time, ask them whether the tone is louder next to the ear or behind the ear. The patient should respond verbally.

Children may choose to point to the ear rather than giving a verbal response.

#### 4.2.3 Interpretation

1. If air conduction (next to the ear canal) is louder, this is a Rinne positive result, indicating either normal hearing or a sensorineural hearing loss
2. If bone conduction (held on mastoid) is louder, this is a Rinne negative result, indicating a significant conductive element to the hearing loss

The Rinne test is able to distinguish a conductive hearing loss with an air-bone gap of 17.5 dB - 30 dB (Jacob et al, 1993; Burkey et al, 1998). It therefore has limited utility in detecting mild conductive hearing losses or mixed hearing losses where there is an air-bone gap of less than 17.5dB. \*\*

\*\*The specificity and sensitivity of both the Rinne and Weber tests have been evaluated. The sensitivity of them is estimated at 76.86% and the specificity was projected to be 85.48%. (Bhat & Naseeruddin, 2004 & Boatman et al. 2007). \*A subsequent study found that when using the Weber test in isolation as a screening tool for sudden sensorineural hearing loss it's sensitivity was likely to be around 78% (Shuman, 2013). The tester should therefore be aware of probable errors through administering Tuning Fork tests, particularly in isolation, rather than as part of a battery of tests.





The tester should be aware that the Rinne test can result in a **False Rinne Negative**. This occurs when the bone conduction transmits through the skull to the opposite ear and is detected through cross hearing by the better cochlea (in the non-test ear). This occurs with a severe sensorineural loss predominantly on the test side. It can be distinguished through considering if the Weber test result is contradictory and through asking the patient which ear the bone conduction part of the test was heard in.

Masking of the non-test ear through the use of tragal rubbing can prevent cross hearing. The tester should place their index finger and thumb either side of the tragus and massage the outside of the tragus to create the masking noise. Please note this is not always efficient and is hard to interpret and it is recommended that if it is required the patient undergoes a fully masked pure-tone audiogram.





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## Appendix: Example test results

Please note that these interpretations are not precise and refer to tuning forks without masking. They must be supplemented by Pure Tone Audiometry with adequate masking wherever possible.

Example	Weber	Rinne		Interpretation
		Right	Left	
1	Central	+ve	+ve	Either:  Bilateral normal  Bilateral mainly symmetrical sensorineural
2	Left	+ve	-ve	Right normal or sensorineural  Left conductive
3	Right	+ve	+ve	Normal or mainly sensorineural losses, probably greater on the left or with a slight conductive element on the right
4	Right	-ve	-ve	Bilateral conductive hearing losses, probably greater on the right but could also be sensorineural in the left (False Rinne negative)
5	Right	+ve	-ve	False Rinne negative due to a severe sensorineural or mixed hearing loss on the left and a relatively normal cochlea on the right
Please note with longstanding SNHL in one ear, the Weber response can be central and not lateralised				

