Tuning fork tests define

Karen J. Tietze PharmD, in clinical skills for pharmacists (third edition), 2012Tuning forks, usually aluminum, consist of a stem (handle) and two protrusions that form a U-shaped fork (Figure 4-13). The tuning fork vibrates at a specified frequency after being hit on the heel of the hand and is used to assess the vibratory sensation and hearing (air conductivity and bone conductivity). Keep the tuning fork from the stem, not the protrusions. Adjustment forks are available in a wide range of frequencies (64 Hz to 4096 Hz). 128 Hz is a frequency commonly used for control. Steven McGee MD, in evidence-based physical diagnosis (Third Edition), 2012 Hearing loss is localized, tuning fork tests distinguishing neurosensoral from conductive loss. All tuning fork tests are based on the same fundamental principle, discovered nearly 500 years ago∗: Sound conducts preferably through bone in the ears with a disease that causes conductive hearing loss. Tuning fork tests were introduced in clinical otology in the early 1800s, and in one year there were over 15 discrete tuning fork tests.6 After the introduction of soundmetry, however, enthusiasm for setting fork tests decreased, and now only two are commonly used, the Weber test and the Rinne test. Steven McGee MD, in documented physical diagnosis (fourth edition), 2018Gability test is tested with a tuning fork (usually 128 Hz; less often 256 Hz). There is no compelling reason for using one tuning fork over the other, except that standards have been developed for the 128-Hz fork. People are more sensitive to vibration frequencies from 200 to 300 Hz and find it difficult to consistently detect frequencies below 100 Hz.5.6 Traditionally the tuning fork is applied to an osteos protruding , although this is based on the mistaken belief that bones contain vibration receptors. the vibratory sensation is just as good or even better over soft tissues without an underlying bone (the clinician can easily prove this by testing the sensation in the abdominal wall).7 When a 128-Hz tuning fork is struck from a distance of 20 cm against the heel of the clinician's palm, a healthy 40-year-old person should perceive vibrations for at least 11 seconds , when the fork stem is held during lateral malleolus and for at least 15 seconds when held against the ulna styloid.8 These values are reduced by 2 seconds for each decade over 40 years of age. One drawback to vibratory tests is the fact that the vibrating impulse is carried out away from the tuning fork, thus preventing the precise determination of sensory limits in patients with peripheral nerve injuries.7Rumpf introduced the tuning fork into the bedside table in 1889.9K. Kubota, in the Encyclopedia of Materials: Science and Technology, 2003There are two possible methods for producing tuning-fork-type crystals: working the crystal in shape with a wire saw, and using a photolithographic process similar to that used for integrated circuits (IC). The first quartz chip produced using the was 5.9 mm × 1.55 mm × 1.00 mm in size. Meanwhile, J.H. Staut (USA) used the photolithographic process to develop crystalline resonator and filters. It produced an NT-cut resonator using a ceramic package, but its high internal strength (max. 32 KHz, 650 KB) made driving difficult. Seiko held this idea in great esteem, but turned from the NT cut to the X-cut for mass-produced clock crystals. Packaging for the use of watches is mainly manufactured as cylindrical types in sizes of diameter 3 mm (diameter) × 8 mm (length) and 2 mm (diameter) × sizes 6(length) mm. For compact watches, a diameter size of 1 mm is also produced. Paul Rea, in the Clinical Anatomy of Cranial Nerves, 2014 Weber test is a trial for pleurising. Press the adjustment fork your palm, then press the tip of the instrument on the top of the patient's head in the middle line and ask the patient where he hears the sound. Normally, the sound is heard in the center of the head or equally in both ears. If there is conductive hearing loss, the vibration will be stronger on the side with conductive hearing loss. If the patient does not hear the vibration at all, try again, but press the butt harder on the patient's head. Torsten Liem DO Osteopath GOsC (GB), in cranial osteopathy (second edition), 2004☐Weber test (Fig. 17.6) Place the stem of a vibrating tuning fork (frequency: 440 Hz) in the middle line at the top of the head or upper margin of the forehead. When hearing is normal or in cases of symmetrical conductive/sensory deafness, there is no lateral configuration of the sound perception, i.e. the patient hears the sound in the middle. Rinne's test is based on the principle that air conductivity is more effective than bone conductivity. First, hold the vibrating tuning fork near the auricle so that the sound is conducted through the air. Then place the still vibrating tuning fork in the mastoid process for bone conductivity (usually less effective than air conductivity). Ask the patient to indicate which stimulus is strongest. Negative Rinne test: in conductive or mean ear deafness (bone conductivity is longer than air conductivity). Positive Rinne test: in patients with normal hearing and in sensory or labyrinthine deafness (air conductivity is stronger and greater than bone conductivity, but where there is pathology, perceptions of air and bone conductivity are reduced.) In combined conductive and sensory hearing loss, tuning performance fork tests only very limited information. This measures the distance at which an oral voice can be heard:☐ Hearing is impaired if a conversational voice at a distance greater than 6 m, or whispered monosyllable at a distance of 6 m is (or only partially audible). During the test the contralateral ear should be mute. This can be done by inserting a finger into the ear (for whispering monosyllable) and in addition by waving the finger in the ear (for a conversational voice). Further specialized medical research include electroacoustic hearing hearing impedance measurements, reflex tests and inductive auditory capabilities of the brain stem and cerebral cortex. Clough Shelton, in Otolological Surgery (Third Edition), 2010 Surgical candidate should have a conductive hearing loss on the ultrasound and confirmed by the tuning fork of at least 15 dB. Acoustic reflexes can be used as a simple screening tool for conductive hearing loss due to superior channel dehiscence, and should be absent. The tympanic membrane should be intact, and there should be no evidence of continued infection in the ear. The patient should not have evidence of cochlear hydropod (see the section on traps). The patient should not have medical contraindications to a short surgical procedure performed under local anesthesia. See chapter 21 for indications and contraindications of surgery stapes. Browse the Journals & Books Objective (1) To determine the diagnostic accuracy of the tuning branch tests (TFTs; Weber and Rinne) to assess hearing loss compared to standard soundmetry. (2) To determine the sound limit at which TFT transitions from normal to abnormal, thus indicating the presence of hearing loss. PubMed, Ovid Medline, EMBASSY, Web of Science, Cochrane, and Scopus data sources and manual bibliographical searches. Review methods A systematic review of studies reporting TFT accuracy was carried out in accordance with a standard protocol. Two independent evaluators confirmed the exported data and assessed the risk of bias. Results Seventeen studies with 3158 participants, including adults and children, met the integration criteria. The sensitivity and specificity of the Rinne test for the detection of conductive hearing loss ranged from 43% to 91% and 50% to 100%, respectively, for a 256-Hz fork and from 16% to 87% and 55% to 100% for a 512-Hz fork. The sound limits at which tests switch from normal to abnormal ranged from 13 to 40 dB of conductive hearing loss for the Rinne test and from 2.5 to 4 dB of asymmetry for the Weber test. Significant heterogeneity in TFT methods and auditory limits for determining hearing loss excluded meta-analysis. There is a high risk of bias in patient selection for the majority of studies. Variability conclusion exists in the reported test accuracy measurements of TFTs for clinical screening, surgical candidacy evaluations, and assessment of the severity of hearing loss. Clinicians should remain cautious about these differences and optimize these techniques in specific clinical applications to improve TFT accuracy. Keywords: Rinne; Weber? sound geometry; hearing test; adjustment fork. A review of the tests that still serve us well There may be a natural tendency for the distribution of professionals to recoil at the idea of a tuning fork test; looks dusty and archaic in front of all our excellent electronic control options. However, two coordination branch trials-the Rinne and Weber-have stood the test of time and retain their importance for clinicians in diagnosing hearing loss. Here is a review of the tests and interpret their results. Prior to the introduction of electronic acoustic testing equipment, clinicians relied heavily on TFT tests along with some other elementary tests, such as Whisper Voice. Even with all electronic and computerized testing equipment available today, TFTs play a critical role as a supplement for clinicians in determining the type of hearing loss in patients. Although some of the TFTs have lost their value, both trials-the Weber and Rinne-have stood the test of time and are still important for clinicians in diagnosing hearing loss. In this paper, we examine the basic principles involved in the use, theory and interpretation of Rinne and Weber. We will also provide a discussion on how to interpret the results, as well as the AC and BC phenomenon that determines the various results seen with these two tests. Introduction In the 100 years prior to the use of electronic diagnostic equipment, clinicians evaluating ear hearing and pathology relied heavily on TFT.1-6 While some clinicians point out that there is a poor statistical correlation between branching tests and auditory tests,7 others have seen the use of TFTs as an important supplement to auditory testing.4 In a previous paper , we pointed out some of the possible errors that can result from supporting modern audiovisual equipment on its own.8 C. Michael Hall, AuD, is a clinical audiologist who lives in Walnut Creek, California, and has now retired from private practice. Carl Crutch, AuD, is an audiologist at the Kaiser Permanente Hearing Center in Daly City, California Tondorf and others10-12 have highlighted the important contribution that TFTs make to clinicians in developing their otological diagnosis. Although there are several TFTs developed before the widespread use of sound meters, TFTs in addition to Weber and Rinne are not of the same clinical value as they were before the introduction of sound meters and immitance bridges. Therefore, only the Rinne and Weber tests will be examined in this article. How Bone Conductivity Tondorf works and colleagues 11.12 offered the most detailed and complete explanations of how bone conductivity (B.C.) works. They stated that Cochlear response to stimulation from bone-conducted vibrations consists in a rather complex way. They went on to say that there are four important bone conductivity components: 1) Middle ear inertia, 2) Compliance with the middle ear, 3) Inner ear compression, and 4) Round window release. The components that seem to contribute little to bone conductivity are: 5) Inner ear fluid inertia, 6) Oval window release and 7) Release through the third (cochlear aqueduct). Tondorf12 comments, All three anatomical parts of the ear, the outer ear canal, the middle ear, and the inner ear, contribute independently to bone conductivity [transmission]. He continued in a later paper11 to further clarify his theory of bone conductivity. Tondorf stated that the 500 Hz and Hz are the frequencies most affected by the inertia of the middle ear.10 With the Rinne test, at frequencies above 1000 Hz, the air-bone gap must be larger in order to observe the fork being louder behind the ear compared to the opening of the meatus. He and other researchers did an excellent job explaining the rationale for 512 Hz and 1024 Hz as preferred frequencies for managing Weber and Rinne. Many clinicians use 200 Hz or 500 Hz as test frequencies for TFTs. For example, at frequencies of 2 to 3 octaves lower than 2000 Hz, an air-bone vacuum half or less of the size than at 2000 Hz is usually necessary to indicate a conductive loss. When there are pathologies of the middle ear, there is an increase in impedance in the plate and oval window, which create travel waves in phase and off phase in the cochlea. Weber Trial Clinically speaking, we know enough about tuning fork tests; However, the mechanisms that explain the interaction of components can be confusing. The factors that explain why the fork laterally in the ear with a conductive pathology when the other ear is normal or has some degree of sensory hearing loss are the same four primary factors previously noted for B.C.: middle ear inertia, middle ear compliance, inner ear compression and round window release. The effect of all these various components results in the production of phase and off-phase travel waves in the screw.11 The situation in the phase leads to an increase in width, which creates a perception that Weber is stronger in the ear with the pathology of the middle ear. When the middle ears are normal, the Weber laterally at best cochlea simply because it is the best ear hearing. Weber and Rinne should be administered at a PK level of 40 to 50 dB HTL (hearing threshold level) using a bone oscillator at 500 Hz or 1000 Hz.11 When a adjusting fork or bone oscillator is super-powered and becomes so strong that it deviates from its fundamental frequency, it will produce deformation. It should be noted that it is common to use the term 512 Hz and 1024 Hz when referring to a coordination branch test. Technically, 500 Hz means 500 Hz tone through the oscillator bone of the sound meter, while 512 Hz is the frequency of the tuning branch. The test results will be the same whether a tuning fork or a bone oscillator is used. In the Weber test, the tuning forks are placed in vibration and the fork stem is pressed in the middle of the forehead. A useful method of recording the results of the TFT is presented in Figure 1 where the Latin origin of these letters. The adjustment fork will not laterally if both ears are normal. This should be reported as the patient hearing in the front midfield (^). The patient will report that he or she either cannot tell if they are louder in one ear or the other, or report their hearing to the FIGURE 1. Symbols for reporting test results with rinne and Weber fork. If a conductive, mixed, or sensory hearing loss is present only in one ear and the other ear is normal or has better sensory hearing, the patient will report hearing of the fork in that ear with conductive loss or ear with greater sensory loss. If a conductive loss is present only in one ear and the other ear has a sensory loss, the patient will still report the fork being louder in the ear with the pathology of the middle ear. If, for example, the patient hears the fork louder at 512 Hz in the left ear, it should be reported: Weber @ 512 Hz > AS. Rinne Test The Rinne test is much easier to explain and understand. The adjusting forks are vibrationd in the same way as when conducting the Weber test. The stem is placed on the mastoid protrusion on one side, and then transferred to the opening of the same ear, while keeping the tuning fork from actually touching the patient's ear. Normally, we instruct the patient that they will hear two sounds: one in the bone behind their ear and the other in their ear. Be warned not to think about what should be the correct answer, but simply to say whether the number 1 (mastoid protrusion) or the number 2 (the opening of the ear) is louder. The results of both TFTs are reported as shown in Figures 2 and 3. For Rinne, if the fork is stronger on the mastoid in both ears, it shall be indicated: Rinne B/C> A/C AU. Looking at Figure 1 will familiarize the reader with a quick and easy method to report TFT results. Symbols are medically acceptable abbreviations, and the interpretation should be clear. FIGURE 2. Cathartone sound metric and branching test results for a patient with unilateral mixed hearing loss. FIGURE 3. Sound metric purine and tuning fork test results for a patient with bilateral sensory hearing loss. Discussion In the administration of fork tuning tests, we have found that patients have no difficulty reporting their observations to the clinician. Even a small verbal child is usually reliable. When conducting Rinne, where there is a difference of 30 dB or greater between the ears, it is recommended to disguise the best ear during the test. If the patient's hearing loss is severe, the clinician can rely on signal marks such as having the patient hold up one or two fingers to show which sound is the loudest. However, in a serious loss without a conductive component present, it is unlikely the coordination fork will be heard. This paper was written with the intention of notifying hearing care clinicians an explanation of two coordination branch trials, Weber and Rinne. These tests, in our opinion, support in more modern audio tests to help all professionals involved in hearing test management. Weber and Rinne can be administered and shared in just a few minutes and can be valuable to help hearing professionals interpret and verify their own test results. This be useful, for example, in cases of conductive hearing loss with normal tympanograms where there is an air-bone gap in the ultrasound, but the patient has no otitis media. Reports Politzer A. In: Cassels JP, ed and translator. A manual of diseases of the ear and adjacent organs. Philadelphia: Lea & Son; 1883. Tschiassny K. Tuning fork tests. A historical review. If Otol Rinol Laringol. 1946; 55:433-430. Hartman A. Ear diseases and their treatment. New York: Putnam & Sons; 1887:26-30. Sheehy JL, Gardner B Jr, Hambley W. Tuning fork test in modern otology. Arch Otolaryngol Head Neck Surg. 1971;91:132-138. Ng M, Jackler RK. Early history of tuning-fork tests. Am J Otol. 1993;14:100-105. 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