

ALTERNATE BINAURAL LOUDNESS-BALANCE TEST

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1. Core Definition

The Alternate Binaural Loudness-Balance Test (ABLB), sometimes referred to simply as the Alternate Loudness-Balance Test, is a specialized **psychoacoustic** procedure utilized primarily within the field of **audiology**. It is designed specifically to detect the presence of **abnormal loudness growth**, a clinical phenomenon known as **recruitment**, in patients exhibiting unilateral hearing loss or pronounced asymmetrical hearing thresholds. Recruitment is the disproportionately rapid increase in the perception of loudness relative to the physical increase in sound intensity, often indicating damage to the cochlear hair cells, particularly within the inner ear's sensory mechanism. The ABLB serves as an essential tool in the differential diagnosis of sensorineural hearing loss, helping clinicians distinguish between damage originating in the cochlea and issues arising in the retrocochlear or central auditory nervous system.

Unlike some earlier iterations of loudness balancing, the ABLB necessitates the use of a control ear--typically the better-hearing ear or the ear with normal hearing--against which the affected ear's loudness perception is compared. The core methodological requirement is that the patient must possess normal or near-normal hearing in at least one ear for the procedure to be valid, as this provides a stable reference point for the subjective assessment of sound magnitude. The test relies entirely upon the patient's ability to compare and equate the subjective volume of two sequential tonal stimuli presented across the two separate ears. The results yield a loudness contour or balance function, mapping the relationship between the physical intensity (decibels) required in the impaired ear to match the perceived loudness generated by a specific reference intensity in the normal ear.

The specific implementation of the ABLB involves presenting a pure tone of an identical frequency to the two ears, but in an alternating or "back-and-forth" temporal pattern. This alternating presentation is critical because it prevents the masking or summation effects that might occur if the tones were presented simultaneously. Furthermore, the test is structured such that the tone presented to the reference ear is held constant at a specific, suprathreshold level (often 20 dB above the threshold of the impaired ear, as suggested by some classical procedures), while the intensity in the test ear is manipulated by the examiner until the patient reports that the loudness of the two alternating tones is subjectively equal. This methodology allows for a precise mapping of the rate of loudness growth in the pathologic ear relative to the presumed normal growth rate in the reference ear.

2. Purpose and Clinical Application

The primary clinical mandate of the ABLB is the quantitative assessment of **recruitment**. Recruitment is considered the hallmark symptom of specific forms of cochlear hearing loss, predominantly those involving dysfunction or damage to the outer hair cells of the cochlea, such as Meniere's disease or noise-induced hearing loss. When recruitment is present, individuals experience soft sounds as muted or unheard, yet sounds just slightly above their elevated threshold quickly reach levels perceived as excessively loud or painful. The ABLB provides objective evidence for this abnormal psychoacoustic phenomenon by charting the reduced dynamic range between the patient's threshold of hearing and their threshold of discomfort.

The diagnostic value of the ABLB extends beyond merely confirming the presence of cochlear damage; it plays a critical role in the **differential diagnosis** between cochlear (sensory) and retrocochlear (neural) pathologies. While full recruitment strongly suggests a sensory, cochlear origin for the hearing loss, the absence of recruitment or the presence of specific patterns like "decrement" (where loudness growth is abnormally slow) can point toward retrocochlear lesions, such as acoustic neuromas (vestibular schwannomas) affecting the auditory nerve. In the era before sophisticated objective audiometric measures, the ABLB provided crucial data guiding neurological referral decisions.

Furthermore, understanding the degree of recruitment is essential for fitting hearing aids effectively. Hearing aids are designed to amplify sound, and if a patient exhibits severe recruitment, standard amplification schemes can quickly drive loud inputs into the uncomfortable or painful range, leading to poor compliance and dissatisfaction. By identifying the specific decibel levels at which loudness equalization occurs, clinicians can program the hearing aid's output compression characteristics--specifically, the input/output function--to limit maximum power output and ensure that amplified sounds remain within the patient's narrowed dynamic range, thereby improving listening comfort and clarity. The ABLB thus bridges diagnostic assessment with practical rehabilitation planning.

3. Testing Procedure and Methodology

The typical ABLB procedure begins by establishing the pure tone **thresholds** for the specific test frequency in both the impaired ear (test ear) and the reference ear. A specific frequency (e.g., 1000 Hz or 2000 Hz) is selected, often one that demonstrates a significant hearing loss in the test ear. The examiner then selects a starting reference level for the tone in the better ear. According to classic methodologies, the reference tone is often set at an intensity that is 20 dB above the threshold of the better ear, establishing a fixed sensory reference point. However, variations exist where the reference is set at a fixed sensation level (SL) or a fixed absolute intensity level (HL) that is comfortable for the patient.

The crux of the ABLB methodology involves the **alternating presentation** of the stimuli. The tone is presented sequentially, first to the reference ear at the fixed intensity, and then immediately to the impaired ear at a starting intensity usually near its threshold. The patient is instructed to compare the loudness of the first tone to the loudness of the second tone. The examiner systematically adjusts the intensity of the tone in the impaired ear until the patient reports that the loudness of the two alternating stimuli is perceived as identical. This point is recorded as the first loudness balance point.

This process is repeated systematically across a range of increasing intensities in the reference ear. The reference ear intensity is usually increased in steps (e.g., 20 dB increments), and at each new reference level, the examiner re-balances the loudness in the impaired ear. By collecting multiple pairs of intensity values (Intensity in Reference Ear vs. Intensity in Impaired Ear), the examiner generates a series of data points that, when plotted graphically, produce the **loudness balance function**. If the hearing loss is conductive, the loudness function will run parallel to the normal hearing line. If full recruitment is present, the function will converge sharply toward the normal line, indicating that equal loudness is achieved despite a significant difference in absolute intensity.

4. Interpretation of Results (Recruitment)

Interpreting the ABLB results involves graphing the obtained loudness balance points, plotting the intensity level of the impaired ear against the intensity level of the reference ear. A normal hearing individual, or someone with a purely conductive hearing loss, will typically demonstrate **complete balance** across all levels, meaning that the intensity required to achieve equal loudness in the test ear is consistently offset from the reference ear by the exact amount of the initial hearing threshold difference. The resulting function would be a straight line running parallel to the line of normal equal loudness.

A positive ABLB finding, indicating the presence of recruitment, occurs when the loudness growth in the impaired ear is significantly steeper than in the reference ear. This means that as the intensity in the reference ear is increased, the intensity required in the impaired ear to maintain equal loudness increases disproportionately slowly. At high intensity levels (near the uncomfortable loudness level, or UCL), the required decibel level in the impaired ear may closely match the required decibel level in the reference ear, despite the initial threshold difference. This phenomenon is termed **complete recruitment** and is highly indicative of a cochlear lesion.

Conversely, a negative ABLB finding, or the absence of recruitment, suggests that the loudness function remains parallel or near-parallel to the normal line, confirming that the hearing loss is likely conductive, or, crucially, that the sensorineural loss is of a retrocochlear nature. In some retrocochlear cases, a phenomenon known as **de-recruitment** may occur, where the loudness

function is shallower than normal. Decruitment implies that the loudness perceived in the damaged ear grows slower than normal, often indicative of neural fatigue or damage to the VIIIth cranial nerve, further strengthening the suspicion of a tumor or neural pathology.

5. Relationship to Loudness Balance Testing

The ABLB is a specific derivative of the general class of loudness balance tests established in the mid-20th century, notably pioneered by Dr. Edmund P. Fowler in 1936 with the introduction of the Loudness-Balance Test (LBT). Fowler's original test, the Monaural Loudness-Balance Test (MLB) or Békésy Loudness-Balance Test, was typically used for patients with bilateral but asymmetric hearing loss. However, the ABLB specifically addresses situations where the individual has one ear that is significantly better than the other, allowing for a binaural comparison where the better ear serves as an internal standard.

The key distinction lies in the ability to directly compare the pathological growth of loudness to a normal sensory system within the same individual. Because the ABLB uses the patient's own healthy ear as the reference, it provides an exceptionally reliable subjective measure of recruitment, minimizing the variability inherent in comparing a patient's results to generalized normative data. The reliability of this internal comparison is what makes the ABLB a powerful and historically significant differential diagnostic tool, particularly when dealing with unilateral hearing loss where the auditory system is structurally intact on one side.

As the source content suggests, the ABLB is often considered an "alternate test form" or "parallel form" of the fundamental loudness balance concept. This designation stems from its methodological similarity to other loudness comparison tests but tailored specifically for the binaural presentation required when a usable reference ear is available. While modern audiology often relies on more objective physiological measures, such as acoustic reflex testing and otoacoustic emissions, the ABLB remains a cornerstone in understanding the subjective patient experience of loudness and is still taught as a foundational method for characterizing sensorineural pathology.

6. Key Characteristics and Nomenclature

The primary characteristics defining the Alternate Binaural Loudness-Balance Test are rooted in its comparative methodology. First, it requires an **asymmetric hearing profile**, typically unilateral hearing loss or a significant interaural threshold difference, which permits one ear to function as the control. Second, the stimuli used are always **pure tones of identical frequency**, ensuring that the comparison is based purely on intensity perception rather than spectral differences. Third, the method utilizes an **alternating temporal presentation**, which is critical for preventing auditory summation or interference that would corrupt the subjective judgment of loudness equality.

The nomenclature surrounding the ABLB can sometimes be confusing due to its relationship with other balancing tests. It is sometimes broadly categorized under the Loudness-Balance Test (LBT) family. However, the specific term "alternate binaural" highlights the requirement of alternating the signal between the two ears, differentiating it from simultaneous presentations or monaural testing. The use of terms like "alternate test form" or "parallel form" emphasizes its role as a reliable variation capable of measuring the same underlying phenomenon (recruitment) as other related tests, but under slightly different structural conditions (i.e., when a reference ear is available).

Historically, the quantitative precision offered by the ABLB allowed audiologists to assign a specific numerical degree to the presence of recruitment, influencing early theories regarding the pathophysiology of inner ear damage. While technology has advanced, the core concept--that damage to the cochlea causes a compression of the dynamic range--remains fundamentally tested through the principles established by the ABLB. Its utility, therefore, rests on its ability to provide a clear, subjective measure of this highly personalized auditory abnormality.

7. Further Reading

[Recruitment \(Audiology\) - Wikipedia](#)

[Audiology - Wikipedia](#)

[Loudness and Psychoacoustics - Wikipedia](#)

[Differential diagnosis of sensory and neural hearing loss](#)