Cochlear Implant System

Neuro 2

Bimodal Fitting Flow

oticon
MEDICAL

Binaural hearing
Bimodal fitting

Binaural hearing is important for sound quality, spatial perception, and speech understanding. It is essential to allow the brain to perceive a full and rich soundscape. To achieve this, the inputs presented to each ear must naturally provide as many sound details as possible. This provides the foundation for the auditory system and the brain to combine the inputs and make sense of sound.

Depending on the patient's hearing loss, a bimodal solution combining a Cochlear Implant (CI) on one ear with a hearing aid on the other ear may be the optimal solution for the patient. Optimizing the inputs on both sides is the first important step in bimodal fittings. In addition, there is a specific need to ensure that the two hearing solutions work optimally together. Therefore, a central aspect of bimodal fitting is to fine tune the hearing aid fitting to complement the CI fitting in the best possible way.

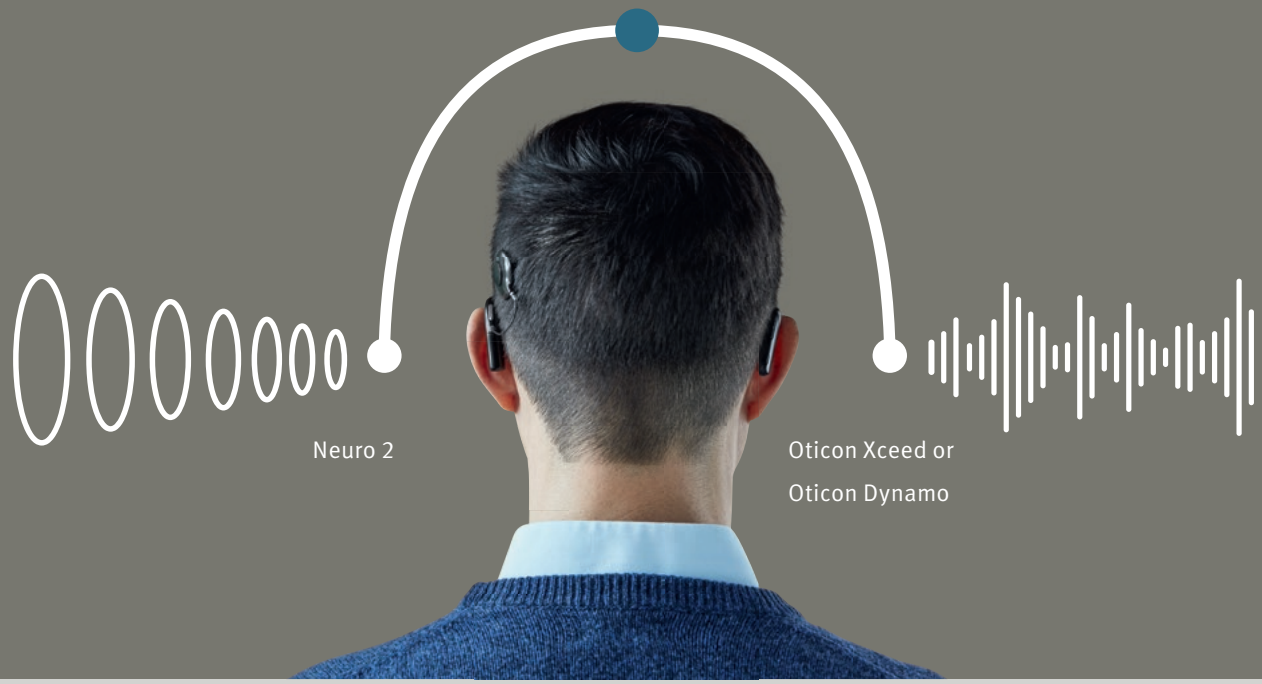
To assist with fitting, we would like to introduce this Bimodal Fitting Flow, which presents the different steps and tools available for a bimodal fitting for an Oticon Medical CI and an Oticon hearing aid – either Oticon Xceed or Oticon Dynamo. This brochure describes Oticon Medical´s present understanding of current state of the art fitting of bimodal patients. Using the Bimodal Fitting Flow, along with the dedicated bimodal fitting tool in the Oticon Genie fitting software, will support optimizing benefits for your bimodal patients.

Oticon Xceed **Neuro 2**

Oticon Dynamo **Neuro 2**

The information in this document does not replace the Instructions for Use (IFU) for Oticon Medical Genie Medical CI, Oticon Genie or Oticon Genie 2. Make sure to familiarize yourself with the relevant fitting software by reading the Instructions for Use.

Binaural model



Who is a candidate for bimodal stimulation?

The provision of bilateral hearing is considered the standard of care for cochlear implant users.[1, 2] Therefore, all unilateral cochlear implant users who have some degree of aidable residual hearing in the contralateral ear should be considered candidates for bimodal stimulation.

Benefits of bimodal stimulation

More than half of those receiving a cochlear implant have aidable hearing in the non-implanted ear.[3] If these users are fitted with a hearing aid in the non-implanted ear, access to bilateral and binaural cues (such as those arising from head shadow and redundancy), as well as complementary acoustic cues (such as fundamental frequency) may enhance cochlear implant performance.

Even users with significant hearing loss in the non-implanted ear demonstrate bimodal benefit.[4, 5, 6]

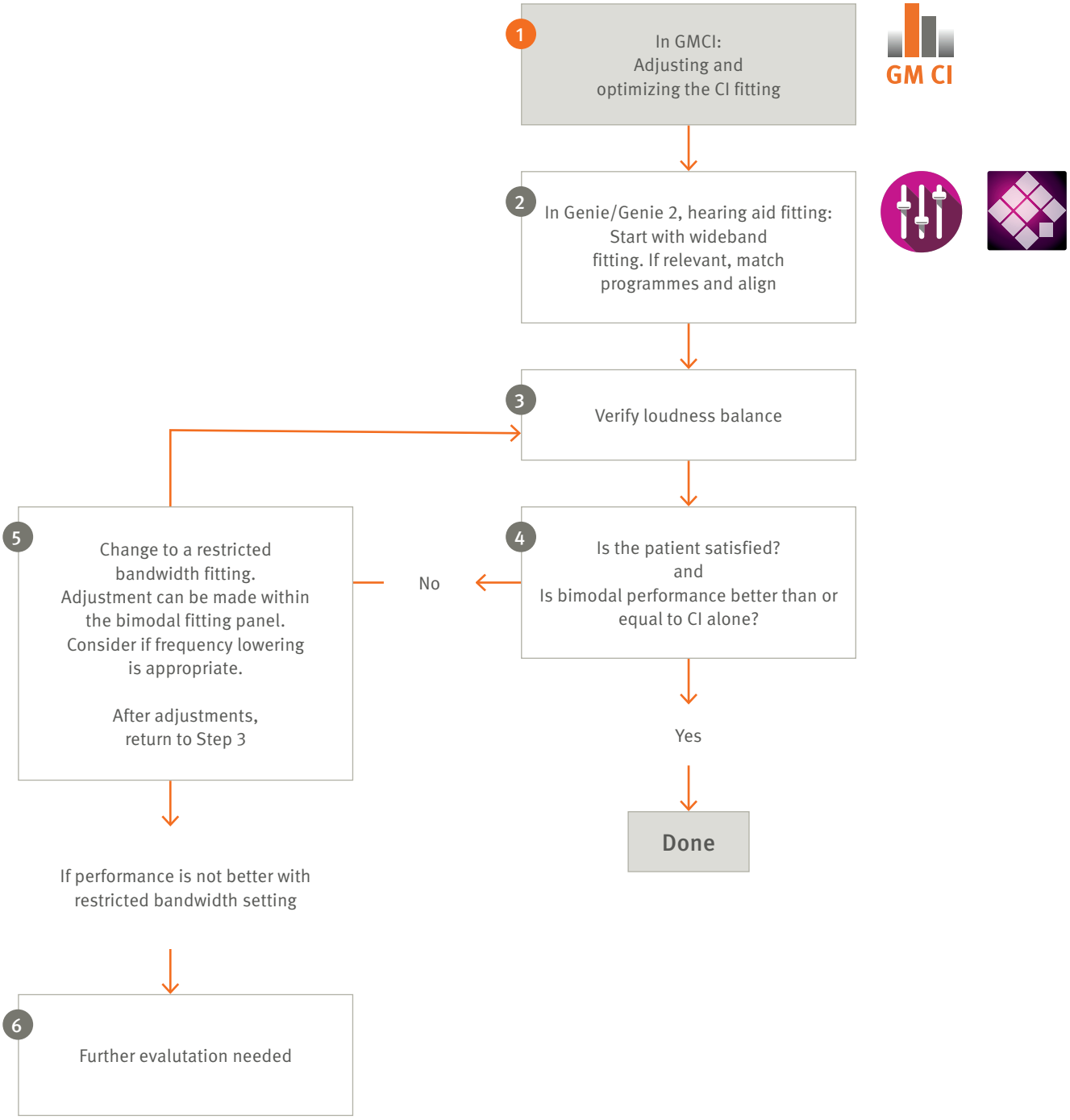
For those who do not obtain bimodal benefit for speech recognition in noise[7], they may still get other benefits such as enhanced music and pitch perception.[8, 9, 10, 11] In addition, many studies have documented more natural sound quality and improved ease of listening with bimodal stimulation.[5, 12, 13, 14, 15, 16, 17] Bimodal stimulation can facilitate spoken language and literary skills in young children who subsequently receive a cochlear implant on the other side.[18, 19, 20]

Optimizing bimodal benefits

Maximizing the useable binaural information for bimodal listeners involves optimizing audibility and sound quality in each ear, and then balancing the loudness between the ears to support listening in a dynamic environment. Because the stimulation from a hearing aid and a cochlear implant are different, it is recommended to consider both sides individually and to start by optimizing the CI side and adjusting the interaural balance with the hearing aid.

In most bimodal situations, the cochlear implant will serve as the dominant listening ear. Therefore, the hearing aid should be adjusted to be equally as loud as the CI, or slightly lower if equal loudness is not achievable.[21]

Bimodal Fitting Flow



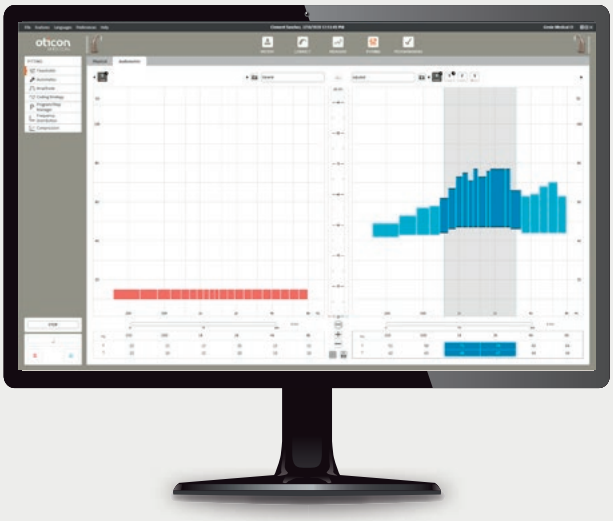
The Bimodal flowchart

The Bimodal Fitting flowchart serves as practical inspiration for clinical audiologists as they navigate in the fitting process to achieve an optimal fitting on a bimodal patient. The goal is to provide a logic and evidence-based method for decision-making, yet keeping in mind the constraints in everyday clinical practice. It is not a “one-size-fits-all” procedure.

The Oticon Medical Bimodal Fitting Flow is inspired by the current practice for fitting of bimodal patients and by the Bimodal flowchart developed by Carisa Reyes, Staff Audiologist at Boys Town National Research Hospital and published in Bimodal Hearing Aid Fitting Guidelines, whitepaper – 2015 by Oticon.

1. Fitting of the CI

It is recommended to start by fitting the CI as you would always do. You can benefit from using the unique audiology-related fitting tools in Genie Medical CI allowing direct adjustments of the MAP in respect to audiometric frequencies used for the free field audiometry. If the patient is fitted with an Oticon Dynamo hearing aid on the contralateral ear, provide a printed programming report or make a note of the Automatics settings used for the Neuro 2 speech processor. These settings will need to be selected when programming Oticon Dynamo, and this information is therefore relevant for the hearing aid audiologist.



Fitting of the hearing aid

The following steps focus on the hearing aid fitting, which is supported by a dedicated bimodal fitting panel in the Oticon fitting software: Genie or Genie 2. Note that both Genie and Genie 2 provide the standard fitting target rules and dedicated proprietary rules optimized for power users. Ideally, hearing aid output should be matched to prescriptive targets for test signals presented at soft, medium and high inputs.

Note that, in some bimodal circumstances, the cochlear implant may need to be adjusted to achieve balanced loudness and comfort until the hearing aid can be adjusted.

The steps described on the following pages are only recommendations. This is not intended to be a "one-size-fits-all" procedure that is applicable to every bimodal user. The cochlear population is extremely diverse and clinical judgment may call for a different approach for a particular patient or patient group.

Oticon Xceed

2. Start with wideband fitting

Wideband fitting means that you should match targets for as wide a bandwidth as possible, fitting to target according to best practice clinical guidelines. Open Sound Navigator™ can remain in default mode for most listening situations.

3. Verify loudness balance

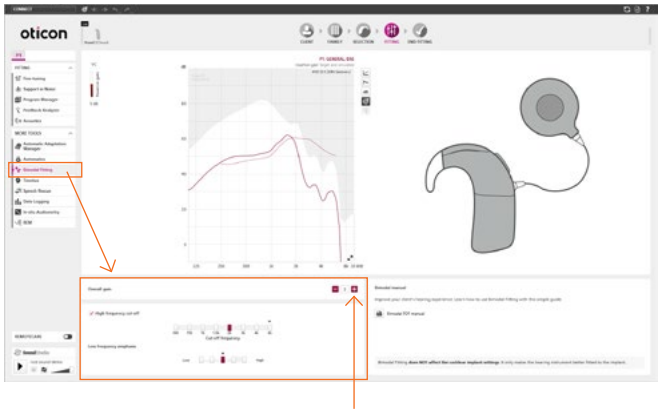
Loudness balancing is important to maximize bimodal benefit. While the patient listens to live sound presented at zero degrees azimuth, ask the patient to point to a picture of a head, to show where he/she hears the sound – balanced sound should be centered. Use the overall gain trimmer within the Genie 2 Bimodal Fitting panel, and turn the loudness of the hearing aid up or down until the patient shows that the sound comes from directly in front.

4. Evaluate the patient´s satisfaction

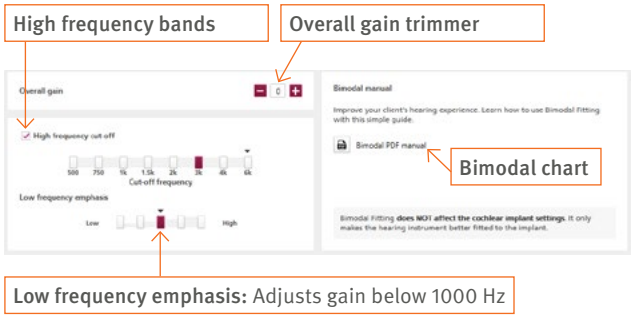
Evaluating the patient's satisfaction level could be done by subjective performance (e.g. the Speech, Spatial and Qualities of hearing scale, SSQ) and/or objective performance comparing the CI (or better ear) alone versus bimodal (e.g. the Minimum Speech Test Battery for Adults (MSTB) or similar).

5. Create restricted bandwidth fitting

Even if amplification of the mid to higher frequencies is possible, this may degrade performance in certain patients. Potential advantages of restricted bandwidth over wideband fitting include improved battery life and better conditions for feedback reduction.



Verify the interaural loudness with both the hearing aid and CI activated. Adjust the overall gain of the hearing aid in order to achieve interaural loudness balance. The Overall Gain control is used for this in Genie 2.



Within the Bimodal Fitting panel: Adjust the High frequency bands cut-off trimmer. High frequency bands are ON by default as part of a wideband fitting. In order to restrict high frequencies, select the OFF button (click High frequency cut-off) and slide the trimmer to the desired cut-off frequency. After restricting High frequency bands, it may be necessary to provide additional low frequency emphasis or an overall loudness increase.

Note that there is no single accepted method for determining how much to restrict high frequency amplification for bimodal users. The edge frequency can be determined using the TEN or SWPTC tests, or by providing amplification up to where thresholds are equal to or better than 80-90 dB HL. You may need to experiment with different cut-off frequencies to determine the one that results in the best possible outcomes. See step 3 for loudness balancing.

Recent studies [22, 23] indicate that frequency lowering techniques typically do not provide benefit for bimodal users. The high frequency sounds will in any case be presented at the CI side. Since frequency lowering may be beneficial to some patients, it can be tested at the end of the bimodal fitting process, if the previous steps were not successful.

6. If further evaluation is needed

If further evaluation of the CI is needed, contact the CI-audiologist. Find more in-depth recommendations on bimodal fitting strategies in the Oticon Tech paper by Elaine Ng: Bimodal hearing aid fitting: Benefits and update in Oticon Genie 2.[24]

Oticon Dynamo

2. Start with Wideband fitting

Align the pre-processing by ensuring Dynamo Automatics Free Focus settings match those on the Neuro 2 speech processor. These settings are available in the GMCI printed fitting report. Proceed with a wideband hearing aid fitting, matching targets for as wide a bandwidth as possible, according to best practice clinical guidelines.

3. Verify loudness balance

Loudness balancing is important to maximize bimodal benefit. While the patient listens to live sound presented at zero degrees azimuth, ask the patient to point to a picture of a head, to show where he/she hears the sound – balanced sound should be centered. Use the overall loudness trimmer within the Genie Bimodal Fitting panel, and turn the loudness of the hearing aid up or down until the patient shows that the sound comes from directly in front.

4. Evaluate the patient´s satisfaction

Evaluating the patient's satisfaction level could be done by subjective performance (e.g. the Speech, Spatial and Qualities of hearing scale, SSQ) and/or objective performance comparing the CI (or better ear) alone versus bimodal (e.g. the Minimum Speech Test Battery for Adults, MSTB).

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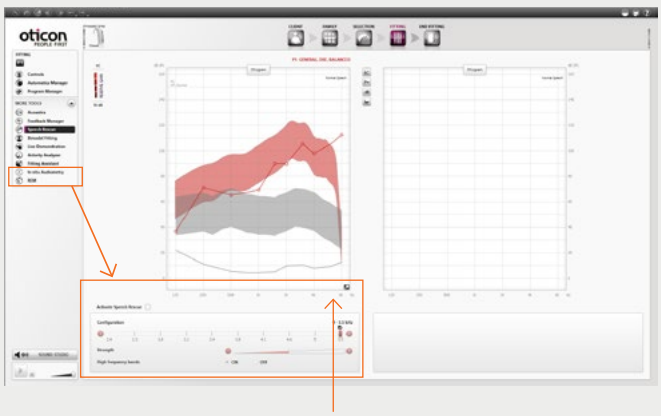
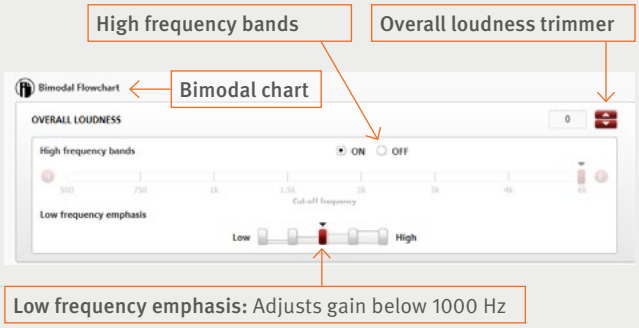


We recommend performing real ear measurement (REM) using Real Ear Coupler Difference (RECD) and/or Probe Microphone Measurements to match the hearing aid output to an evidence-based prescriptive target.



Within the Bimodal Fitting panel, adjust the High frequency bands cut-off trimmer. High frequency bands are ON by default as part of a wideband fitting. In order to restrict high frequencies, select the OFF button and slide the trimmer to the desired cut-off frequency. After restricting high frequency bands, it may be necessary to provide additional low frequency emphasis or an overall loudness increase.

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If further evaluation of the CI is needed, contact the CI-audiologist. Find more in-depth recommendations on bimodal fitting strategies in the Oticon whitepaper by Carisa Reyes: Bimodal Hearing Aid Fitting Guidelines.[25]

Bimodal fitting: Standard of care

Concluding remarks

There are well-documented benefits of bimodal fitting over unilateral cochlear implant alone for adults and children, even though there are no standardized procedures on bimodal fitting for optimizing benefits. The fitting flow in this brochure is inspired by the bimodal hearing aid fitting guidelines and flowchart developed by Reyes[25] (2015) and provide a basis for use of different fitting approaches and decision-making in the bimodal fitting process. The bimodal fitting tools in Oticon Genie and Genie 2 allow finer adjustments, which support hearing care professionals to optimally fit the hearing aid to complement the implanted ear.

Oticon Xceed Neuro 2

Oticon Dynamo Neuro 2

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Because sound matters

Oticon Medical is a global company in implantable hearing solutions, dedicated to bringing the magical world of sound to people at every stage of life. As part of the Demant group, a global leader in hearing healthcare with 15,000 people in over 130 countries, we have access to one of the world's strongest research and development teams, the latest technological advances and insights into hearing care.

Our competencies span more than a century of innovations in sound processing and decades of pioneering experience in hearing implant technology. We work collaboratively with patients, physicians and hearing care professionals to ensure that every solution we create is designed with users' needs in mind. We share an unwavering commitment to provide innovative solutions and support that enhance quality of life for people wherever life may take them. Because we know how much sound matters.

Oticon Medical

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