



College of  
**Speech and Hearing**  
Health Professionals of BC

# Practice Guidelines for Dispensing Hearing Aids to Adults

Current to October 25th, 2010

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## PREAMBLE

### (1) Focus

This document is intended to provide the practitioner with policy and preferred practice for hearing instrument dispensing for adults in British Columbia. The scope of this document includes assessment as it pertains to hearing instrument fitting, HI selection and verification, orientation, follow-up, and outcome measures as they pertain to HI fitting. Other aspects of scope of practice for audiologists and HIPs are defined in separate practice guidelines.

### (2) Background

The materials incorporated in this guideline are taken from the former Board of HA Dealers and Consultants, curriculum from educational programs in Canada, published systematic reviews of evidence-based practice regarding HA fitting for adults, and primary research articles. The working group that created the draft guidelines was composed of both audiologists and hearing instrument practitioners, representing private practice, public health, and academia. All members of the working group reviewed existing documents of relevant practice guidelines, then worked in teams on sections that corresponded to the stages of the hearing instrument fitting process. The Standards of Practice for Dispensing Hearing Instruments document (Board of Hearing Aid Dealers and Consultants of BC, 2005) was used as the basis for the guidelines, and was adapted by each team to ensure consistency with current evidence-based procedures. The entire working group then reviewed all sections of the document and final decisions were made by consensus through discussion of relevant literature and practicalities.

The document will next be reviewed by the Quality Assurance committee of the CSHPBC, then the full board, then distributed to registrants for comments and feedback.

The guidelines consist of two distinct documents that complement one another: 1) Policy; and 2) Practice Guidelines.

- **Policy** consists of a brief listing of the mandatory aspects of the hearing instrument process. All hearing instrument fittings for adults in BC must incorporate each of the steps listed, along with documentation of the steps. It should be noted that the wording is often fairly general, allowing each practitioner flexibility in choosing the preferred procedure. For example, the first mandatory item in policy is “Case History information must be obtained for every patient, kept on file in either paper or electronic format, and updated whenever changes are reported.” The policy does not further specify what information must be obtained, nor how that information is obtained, allowing each clinician the freedom to create personalized case history forms for their clinic, or take the case history verbally, or use standardized forms.

- **Practice Guidelines** include details of recommended practice, justification for policy and guidelines, and very detailed appendices for the interested reader who wishes to learn more about certain topics. An extensive reference list rounds out the practice guidelines, providing clinicians with numerous additional

sources to consult. The Working Group hopes that clinicians will find the Practice Guidelines to be useful, interesting, and informative, as we intended the guidelines to be a good clinical resource.

We are aware that hearing instrument technology is changing extremely rapidly, and these changes may affect some of the details of hearing instrument fitting. The basic requirements, as outlined in the policy document, are not expected to change with new technology. The Practice Guidelines are current as of August 2010, but they are unable to provide details related to the fitting of new and emerging hearing instrument technologies. Therefore, it is incumbent upon the practitioner to keep current regarding new technology and recommended selection and verification procedures for the technology.

The Policy and Practice Guidelines will be reviewed by a small working group every two years to determine whether changes are needed and to update the document.

### **(3) Definitions**

Each section of the practice guidelines has its own specific terminology, and where needed, definitions will be provided. Definitions also include clarification of the manner in which a term is used. There are also some terms that are used throughout the policy and practice guidelines for which we provide definitions here.

**"clinical note"** means any record about or relevant to the client or hearing aid fitting process. The note may be electronic, written, typed, or printed, as long as the note is in a form that can be stored and retrieved for 7 years.

**"documentation"** is generally interchangeable with the term "clinical note."

The term **"client"** is used throughout document. Where appropriate, this term generally also refers to family or caregivers or both. For ease of reading the document, the full phrase "client or family members or caregivers" is replaced with just "client."

The term **"real ear measurements"** is the preferred terminology and can be understood to mean probe-tube measurements, probe-mic measurements, or other variations. This term is consistent with the Health Professions Act: Speech and Hearing Health Professionals Regulation (B.C. Reg 413/2008).

For standardization within this document, we have chosen to use the term **"hearing instrument"** throughout to be consistent with the Regulations (B.C. Reg 413/2008). It can be understood that this term is synonymous with "hearing aid" and "hearing device."

**The following definitions are reprinted from the Health Professions Act: Speech and Hearing Health Professionals Regulation (B.C. Reg 413/2008) for reference:**

**"cerumen management"** means services related to the removal of cerumen for the purpose of audiological procedures that require a clear external ear canal to satisfactorily complete the procedure;

**"dispense"** means to select, prepare, alter, sell or offer to sell;

**"fit"** means to adapt or verify, using sound field testing, real ear measurements or other methods;

**"hearing instrument"** means an appliance or a device designed or offered for a hearing condition,

(a) including any ear molds, boots or other acoustic couplers and any parts or accessories for the appliance or device intended to affect the sound pressure level at the eardrum, and

(b) excluding direct audio input accessories, batteries and any accessories that are attachable to the appliance or device by the wearer and not intended to affect the sound pressure level at the eardrum;

**"hearing instrument dispensing"** means the health profession in which a person provides the services of

(a) assessment of hearing using an audiometer, or other methods, to identify hearing loss, and

(b) recommending, selecting, preparing, altering, adapting, verifying, selling and offering to sell hearing instruments;

**"prescribe"** means to issue an authorization to dispense for use by a named individual;

**"sell"** means to enter into a transfer of title, conditional sale contract, lease, hire purchase or any other contract where a person disposes of, and any other person acquires, a hearing instrument, excluding a wholesale transaction;

**"wearable hearing instrument"** means a hearing instrument wearable on the head or body.

#### **(4) Expected Outcomes/Objectives**

The overarching goals of the hearing instrument fitting process are:

1. To determine a patient's candidacy for hearing instrument(s);
2. To help patients understand and accept their hearing loss;
3. For clinicians to use evidence-based practice in selecting hearing instrument(s) for their client, where evidence-based practice incorporates a) current research; b) clinical experience; and c) client's informed preferences;
4. To provide audibility, intelligibility, and loudness comfort for aided speech and other relevant signals
5. To determine whether the fitting goals have been met using both objective and subjective measures to *verify* the fitting and to measure outcomes.

#### **(5) Indications for use**

The policy and guidelines of this document should be used whenever an adult client identifies as, or may be, a hearing instrument candidate. Policy must be followed for every hearing instrument fitting. The guidelines can be consulted as the practitioner wishes to do so.

## **(6) Procedures and Methods**

- Not applicable.

## **(7) Documentation**

- Not applicable.

## **(8) Appendices**

- Not applicable.

# **A. ASSESSMENT and GOALS**

## **(1) Focus**

The initial step in the fitting of hearing instruments is an audiometric assessment to determine the type and magnitude of the hearing loss, and a needs assessment to determine the impact of any hearing loss on communication, safety and lifestyle. In addition, red flags or risk factors are also identified in the assessment phase, resulting in a referral for medical consultation.

## **(2) Background/Tools, Equipment, and Instrumentation**

- Case history and needs assessment questionnaires
- Instrumentation including otoscope, diagnostic audiometer and a sound attenuation booth (See Appendix for specifications)
- Additional instrumentation may include equipment for physiological tests (See Appendix for specifications).

## **(3) Definitions**

- Hearing screening: for adults, determining the presence or absence of air conduction responses at normal levels (less than or equal to 25dB HL from 250 through 8K Hz)
- Hearing threshold assessment: determining air conduction thresholds for the purpose of monitoring hearing levels
- Hearing assessment: a comprehensive evaluation which includes case history, otoscopic examination, a standard battery of audiometric tests and other tests as indicated
- Case History: consists of answers to a series of questions regarding the relevant medical and functional hearing history
- Needs Assessment Questionnaires, such as the COSI or GHABP. Refer to section on Outcome Measures.

## **(4) Expected Outcomes/Objectives**

- Identification of factors in the client's background that may put him at risk for hearing problems and identification of red flags that would require medical evaluation

- Identification of problems with hearing and understanding, impact of hearing loss on lifestyle and daily activities, and identification of the impact of the hearing loss on family, friends and in the workplace
- Identification of client attitudes and expectations of remediation and amplification, and family members' concerns regarding client's hearing difficulties
- Determination of the client's main goals for his or her hearing health
- Hearing loss is quantified and qualified as to degree, type and configuration, and associated communication disorders are identified.

#### **(5) Indications for use**

- Individual referred through hearing screening or hearing threshold assessment
- Self-referral, family referral, or referral from other professionals
- Hearing being reassessed for an existing client requiring new hearing instrument fitting (within six months).

#### **(6) Procedures and Methods**

- Application of case history and needs questionnaires, interviews with client and client's family/significant others
- Otoscopic examination
- Hearing assessment for the purpose of fitting hearing instruments to adults consists of the following measurements:
  - Pure tone air and bone conduction thresholds
  - Speech reception/spondee thresholds
  - Word recognition scores in quiet obtained at a level sufficient to assure maximum intelligibility
  - Tolerance for loudness
  - Additional measures, such as Word Recognition at multiple levels, speech discrimination in noise, Signal to Noise Ratio loss for speech or Speech Intelligibility Index calculations that may contribute to a successful fitting are encouraged, but are not mandatory
  - Physiological function tests (e.g., acoustic immittance, acoustic reflexes, and otoacoustic emissions) may be included
  - Assessment of tinnitus may be included
- Testing can be performed with either insert earphones or headphones.

#### **(7) Documentation**

- Client files should be maintained with appropriate chart notes related to the process of the assessment
- Case history must be completed for every client and kept on file, and updated as necessary (See Appendix)

- Consent forms to obtain or release previous assessments or hearing instrument information and to discuss hearing healthcare with [named] family members/caregivers
- Audiogram
- Notations or printouts of any test results
- Reports or rehabilitation plan, including referrals
- Medical clearance for amplification: notation or report from GP/ENT, or chart notation of verbal report from client that medical clearance was received, or chart notation of verbal report from client declining recommendation for medical consult
- Calibration records.

## **(8) Appendices**

- **Red Flags**
  - Rapid onset or fluctuating hearing loss
  - History of active drainage activity in the preceding 90 days or visible drainage on examination
  - Ongoing ear pain
  - Unilateral or pulsatile tinnitus
  - Acute or chronic dizziness
  - Foreign object in the meatus or occluding cerumen (unless the registrant has been granted Advanced Certification in Cerumen Management by the College)
  - Visible or unexplained abnormality of the external ear canal
  - Unilateral hearing loss greater than 30 dB HL at any one frequency
  - Air/bone gap greater than 15 dB at 500 Hz, 1000 Hz and 2000 Hz
  - Difference of greater than 40% between ears on word recognition scores using a 25 word list (recorded presentation) with a symmetrical hearing loss
  - Child under the age of 16 years: *Until March 31, 2011*, a hearing instrument practitioner who is not also an audiologist may provide services to children if the child has been examined, within the 6 months immediately preceding the date the service is provided, by an otolaryngologist and an audiologist, and the hearing instrument practitioner has a copy of each diagnosis which recommends that the child use a hearing instrument. *Effective April 1, 2011*, a hearing instrument practitioner who is not also an audiologist may provide services that include the performance of restricted activities (otoscopy, taking earmold impressions, prescribing, dispensing or fitting a wearable hearing instrument) to children if the practitioner has been granted Advanced Certification in Providing Hearing Instrument Services to Children, by the College.

- **Audiogram and Standardized Audiometric Symbols**

Audiogram shall include name of client, birthdate or age, otoscopy results, type of transducer(s) used, reliability of test results, type of audiometer, name of examiner, and date of examination.

Information available at <http://www.asha.org/docs/pdf/GL1990-00006.pdf>.

- **Audiometric Test Environment**

Testing should be done in a commercially available sound attenuation booth. If mobility or medical conditions prevent a client travelling to the clinic, the use of a substitute test environment shall be noted on the audiogram and insert earphones must be used whenever practical. The suitability of the non-standard test environment must be measured against the maximum permissible ambient noise standard [ANSI S3.1-1999(R2008)] using a sound level meter capable of measuring dB SPL re 20 µPa for octave bands 125 through 8000 Hz. If noise levels exceed the standard, either a more suitable test environment should be found, or substandard test conditions and implications for the reliability of the test results must be noted on the audiogram.

- **Audiometric Equipment**

All equipment is to be calibrated in accordance with current ANSI standards and be maintained in good working order:

- A diagnostic audiometer with air conduction, bone conduction, speech, narrow band noise masking and speech noise masking capabilities, as defined under current ANSI standards, is required
- Instrumentation capable of delivering recorded speech is required when testing is conducted in a room with both the examiner and the client present (in the same room)
- Instrumentation for physiological measures is to be maintained in accordance with manufacturer and ANSI standards.

- **Case History**

A case history should contain, but not be limited to, the following information:

- Personal information, including name, address and contact information, date of birth, referral source, family physician
- Hearing and medical history, including family history of hearing loss, incidence and duration of childhood hearing-related illnesses, history of noise exposure and acoustic trauma, diseases and treatment, red flag symptoms (see Appendix), medication/drug history, current medical conditions

- Needs and expectations, including impact of hearing loss on daily activities and lifestyle, motivation, expectations and goals regarding amplification, family members' concerns about hearing difficulties and expectations regarding amplification
- Previous assessment and experiences with amplification

The case history may also contain information about family contacts, power of attorney, third party insurance numbers, occupation (past/present), and retirement date. It may also include information about family members' concerns about the client's hearing difficulties and the family's expectations for improvement with amplification.

- **Pure Tone Air and Bone Conduction Testing**

Pure tone air conduction testing (as per current ANSI standard):

- Transducers can be either supra-aural/circum-aural earphones or insert earphones. Supra-aural or circum-aural earphones are held in place by a headband with the earphone grid directly over the entrance of the ear canal. Insert earphones are placed comfortably deep in the ear canal and in accordance with manufacturer recommendations
- Stimuli include continuous or pulsed pure-tone signals
- Frequencies tested include 250, 500, 1000, 2000, 3000, 4000, 6000 and 8000 Hz.
- Using an ascending/descending protocol, the better ear should be tested first, with the initial test frequency being 1000 Hz. Following the initial test frequency, testing should proceed with 2000 Hz, 3000 Hz, 4000 Hz, 6000 Hz and 8000 Hz, followed by a retest of 1000 Hz before testing 500 Hz and 250 Hz. A retest of 1000 Hz is not necessary when testing the second ear.
- Appropriate masking should be applied to the non-test ear when the air-conduction threshold obtained in the test ear exceeds the inter-aural attenuation to the non-test ear.

Pure tone bone conduction testing (as per current ANSI standard):

- The bone-conduction vibrator placement should allow mastoid or forehead placement with proper force applied. The test ear should not be covered for standard bone-conduction measurements.
- Stimuli include continuous or pulsed pure-tone signals
- Frequencies testing should include 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 3000 Hz and 4000 Hz
- The initial frequency tested should be 1000 Hz. Following the initial test frequency, testing should proceed with 2000 Hz, 3000 Hz and 4000 Hz, followed by a retest of 1000 Hz before testing 500 Hz and 250 Hz.

- If the unmasked bone-conduction threshold is 10 dB better than the air-conduction threshold at that frequency in either ear, masking must be used.

- **Speech Testing in Quiet and in Noise**

Speech Reception Threshold (SRT)

- <http://www.asha.org/docs/html/GL1988-00008.html>
- Recorded Speech Material recommended, but if live voice is used, ensure visual cues are eliminated
- Familiarization of the word list at 25 dB SL PTA (Pure Tone Average of 500, 1000 and 2000 Hz).
- Client is instructed to repeat or indicate the words heard
- If the response is correct, then descend in 10 dB increments, presenting one spondaic word at each level until the client responds incorrectly
- Upon an incorrect response increase in 5 dB increments until a correct response is obtained, then repeat procedure
- The SRT is the point at which the listener can respond correctly 50% of the time

Word Recognition Testing in Quiet and in Noise

- Recorded Speech Material recommended. If live speech is used, ensure no visual cues are provided
- No familiarization of the word list is conducted
- Client is instructed to repeat or indicate the words heard, leading into each word with “Say the word...” or “You will say ...”
- Minimum 25 word list presented to each ear
- Test material presented at MCL
- Word Recognition Testing is scored as a percentage of correct words at a stated presentation level, indicating masking level (if needed)
- Testing can be done with noise to determine the ability to understand speech/words in a noisy environment. Standardized tests included the HINT or Quick SIN (QSIN).

- **Loudness Tolerance Testing**

Establishment of thresholds of discomfort (TD), using frequency-specific stimuli (e.g., pure-tones, warble-tones, 1/3 octave narrow-band noise) is recommended. A speech Uncomfortable Listening Level may be assessed for clients who cannot reliably provide tonal TDs.

- **Tinnitus Assessment**

Tinnitus assessment includes written questionnaires, an intake interview, audiologic evaluation, and a psychoacoustic assessment of tinnitus perceptual characteristics.

- **Physiological Assessment**

Immittance testing – To be reviewed in separate document

- **Masking Procedures Using Inserts and Standard Headphones**

The following charts summarize masking protocols, all based on the plateau method of masking, that are currently (2010) taught in the following programs:

- Grant MacEwan University – Hearing Aid Practitioner Program
- I.I.H.I.S. Hearing Instrument Studies Distance Education Program
- U.B.C. Masters program in Audiology.

The College finds all of these protocols acceptable; this is because that while research has consistently shown that the 'Plateau Method' is superior to other methods, it has not been able to show that one protocol is superior to another.

**Grant MacEwan University – Hearing Instrument Dispensing Program**

<b>Masking Protocol</b>			
TE=Test Ear NTE = Nontest Ear ABG = Air Bone Gap PL=Presentation Level OE=Occlusion Effect			
<b>Test</b>	<b>When to Mask</b>	<b>Initial Noise Level</b>	<b>Process</b>
<b>Air Conduction Pure tones</b>	<b><math>AC_{(TE)} - BC_{(NTE)} \geq 40</math></b>	<b><math>AC_{(NTE)} + 10 \text{ dB}</math></b>	<b><u>Plateau Method</u></b> Increase the noise by 5dB for each response and increase the signal by 5 dB for each nonresponse, until the signal remains constant for a 15dB increase in noise.
<b>Bone Conduction Pure tones</b>	<b><math>ABG_{(TE)} \geq 15</math></b>	<b><math>AC_{(NTE)} + 10\text{dB} + \text{OE}^*</math></b> *Headphones 30dB at 250 Hz 20dB at 500 Hz 10dB at 1000 Hz	
<b>SRT</b>	<b><math>SRT_{(TE)} - \text{best}</math></b> <b><math>BC_{(NTE)} \geq 40</math></b>	<b><math>SRT_{(NTE)} + 10 \text{ dB}</math></b>	
<b>Word Recognition</b>	<b><math>PL_{(TE)} - \text{best}</math></b> <b><math>BC_{(NTE)} \geq 40</math></b>	<b><math>PL_{(TE)} - 20\text{dB}</math></b> Or <b><math>PL_{(TE)} - 30\text{dB}</math> if can't tolerate PL - 20</b>	Turn on the noise at the initial intensity level.  Complete the test with the noise constant at the initial masking level.

Inter-aural Attenuation

Air Conduction Avg. = 40dB (headphones)

Hz 125 250 500 1K 2K 4K 8K

IA 35 40 40 40 40 50 50

Bone Conduction = 0 to 10 dB

**I.I.H.I.S. – Hearing Instrument Studies Distance Education Program**

<b>Masking Protocol</b>			
TE=Test Ear NTE = Nontest Ear ABG = Air Bone Gap PL=Presentation Level OE=Occlusion Effect			
<b>Test</b>	<b>When to Mask</b>	<b>Initial Noise Level</b>	<b>Process</b>
<b>Air Conduction Pure tones</b>	$AC_{(TE)} - 40dB \text{ IA} \geq AC_{(NTE)}$ <b>Or</b> $AC_{(TE)} - BC_{(NTE)} \geq 40$	$AC_{(NTE)} + 10 \text{ dB}$	<b>Plateau Method</b> Increase the noise by 5dB for each response and increase the signal by 5 dB for each nonresponse, until the signal remains constant for a 15 - 20dB increase in noise. Check for overmasking: $EM_{(NTE)} \geq AC_{(TE)} + 40dB$
<b>Bone Conduction Pure tones</b>	$ABG_{(TE)} \geq 15$	$AC_{(NTE)} + 10dB + OE^*$ * Headphones 15dB at 250 Hz 15dB at 500 Hz 10dB at 1000 Hz	
<b>SRT</b>	$PL_{(TE)} \geq 40 \text{ of } PTA_{(NTE)} \text{ or } SRT_{(NTE)}$	$PL_{(TE)} - 20dB$	Turn on the noise at the initial intensity level. Complete the test with the noise constant at the initial masking level.
<b>Word Recognition</b>	<b>Always</b>	$PL_{(TE)} - 20dB$	Turn on the noise at the initial intensity level. Complete the test with the noise constant at the initial masking level.

Type of Masking Noise recommended:

Broad band for masking speech audiometry

Narrow band noise for masking pure tones

Interaural Attenuation

Air Conduction Avg. = 40dB (headphones)      70 dB (inserts)

Hz	125	250	500	1K	2K	4K	8K
IA	40	40	50	55	60	65	70

Bone Conduction = 0 dB

Speech = 40 to 50 dB

# U.B.C. Masters program in Audiology AUDI 552 – Diagnostic Audiology, “Clinical Masking: How and when to mask”,

Course Lecture Notes, January – April 2010; Instructors, Susan Small, Navid Shahnaz

Masking Protocol			
TE=Test Ear NTE = Nontest Ear ABG = Air Bone Gap PL=Presentation Level OE=Occlusion Effect EM=Effective Masking			
Test	When to Mask	Initial Noise Level	Process
Air Conduction Pure tones	$AC_{(TE)} - IA \geq AC_{(NTE)}$ or $AC_{(TE)} - IA \geq BC_{(NTE)}$	$AC_{(NTE)} + 15\text{ dB}$ (minimum = $AC_{(NTE)}$ then add 15 to be safe)	<b>Plateau Method</b> Start initial masking level. If $AC_{(TE)}$ stays the same or changes by 5 dB, accept AC TH and record as masked. If $AC_{(TE)}$ changes by 10dB or more, increase noise by 5 dB. Repeat until $AC_{(TE)}$ stays the same while masking increased by 5 dB in 3 consecutive steps. Check final masking level for over masking:
Bone Conduction Pure tones	$ABG_{(TE)} > 10$	$AC_{(NTE)} + 15\text{dB} + OE^*$  *Headphones 20dB at 250 Hz 15dB at 500 Hz 5dB at 1000 Hz  Inserts 10dB at 250 Hz	
SRT	$AC_{(TE)} - IA > BC_{(NTE)}$ IA = 45-10= 35	$PL_{(TE)} - 35\text{dB} + \text{avg } ABG_{(NTE \text{ at } .5,1K,2K \text{ Hz})}$	$EM_{(NTE)} - IA < BC_{(TE)}$
Word Recognition	$AC_{(TE)} - IA > BC_{(NTE)}$ IA = 45-20= 25	$PL_{(TE)} - 25\text{dB} + \text{avg } ABG_{(NTE \text{ at } .5,1K,2K \text{ Hz})}$	

## Interaural Attenuation

Air Conduction – Headphones

Hz	125	250	500	1K	2K	4K	8K
IA	35	40	40	40	45	50	50

Air Conduction - Inserts

Hz	250	500	1K	2K	3K	4K	6K
IA	75	85	75	65	65	60	65

Bone Conduction = 0 dB

Speech = 45 dB

## **B. TREATMENT PLANNING and HEARING INSTRUMENT SELECTION**

### **(1) Focus**

- The objective of this segment of the fitting process is to determine hearing instrument candidacy based on the client's auditory and non-auditory needs assessments, select appropriate amplification systems and to determine whether referrals should be made for other treatment plans
- Other Hearing Instrument Technologies (wireless Bluetooth devices, FM systems) and Assistive Listening Devices selection (telephone amplification, alert systems, etc.) will be covered under a separate practice guideline.

### **(2) Background**

- Professional judgement and individual client characteristics may substantially affect the nature, extent and sequence of services provided
- Decision making and interpretation regarding diagnosis, treatment planning and hearing instrument selection occurs throughout this process
  - The goal of the hearing instrument selection process is to define the appropriate physical and electroacoustic characteristics of the desired hearing instruments for a particular individual using methods that facilitate ordering, verification of devices. The selection process should incorporate the principles of evidence-based practice, particularly for the selection of optional features and advanced processing
- The selection of hearing instrument system involves the clinician outlining for the client the monetary costs of the hearing instrument selection, optional features and advanced processing. It is recommended that a written purchase agreement be prepared should the client wish to proceed with the recommendation of the hearing instrument selection. See Section 8) Documentation.
- Tools Required:
  - Results from Assessment: Case History, Audiogram complete with Otoscopic Inspection remarks, Subjective assessment (e.g., COSI, APHAB, GHAPB, etc) pre-tests are used to determine listening needs
  - A means to determine gain and output targets
  - Other tools: Otoscope, Otoblock, ear impression material, ear impression apparatus (see Appendix: Ear Mold Impressions).

### **(3) Definitions:**

- **Hearing Instrument Candidacy:** determine hearing instrument candidacy based on the client's auditory and non-auditory needs assessments, select appropriate amplification systems
- **Treatment Planning:** includes recommendation for amplification, medical referral, counselling programs for client, family, caregiver, connecting with hearing support groups, aural rehabilitation, cerumen management, and tinnitus management, other device referral, and follow up care
- **Validated Prescription Fitting Formulae:** different methods are known to calculate the target hearing instrument gain and maximum output from measured audiometric data and other relevant variables. The target gain should amplify normal speech to a level that results in audibility, intelligibility, and comfort for the hearing instrument user. Examples of prescriptive methods currently in use are:
  - NAL-NL1 / NAL-NL2 (National Acoustics Laboratory-Non-Linear version 1 or version 2)
  - DSLm[i/o] (Desired Sensation Level multistage input/output)
  - NAL-RP (National Acoustics Laboratory-Revised, Profound) - only provides targets for a linear fitting

NOTE: See Fitting and Verification section for further discussion/explanation.

### **(4) Expected Outcomes/Objectives**

- In consultation with the client and family, taking into account lifestyle, special needs, hearing loss, physiology of the ear, physical abilities, cognitive abilities, technology, price category preferences, this phase of hearing instrument fitting results in selection of the personal amplification system that will be most appropriate for the communication needs of the client
- The appropriate desired specifications for the hearing instrument will be identified
- Foster realistic expectations of performance with hearing instruments by counselling the client, family and/or caregiver regarding potential benefits and limitations associated with personal amplification
- Ensure the client receives appropriate support and attention for initiated treatment plans including other referrals as required.

### **(5) Indications/Contraindications for Use**

- Indications
  - Individuals identified with hearing loss who have reached a level of acceptance regarding their loss and seem ready to undertake a trial period using amplification

- Contraindications ("Red Flags")
  - Refer to the Red Flags to determine whether medical referral is required. If so, do not initiate any other treatment until medical clearance is received.

## **(6) Procedures & Methods**

- Treatment Planning: See Indications/Contraindications for Procedures
  - Review any third-party benefits for which the client may be eligible, and initiate the appropriate process
- Selection:
  - Determine hearing instrument(s) needed for severity, type, and configuration of hearing loss, keeping in mind the client's history, age, lifestyle, dexterity, special needs, previous hearing instrument use and preference, and results of the hearing evaluation
  - Discuss with client the various levels of technology and different price categories to assist in determination of hearing instrument
- Selection of Electroacoustic characteristics
  - Fitting range to be considered
  - Reserve gain should be a minimum 10 dB
- Selection of Physical characteristics
  - HA style: The choice of hearing instrument style (custom, behind the ear, open fit BTE) should be made based on factors such as gain and output requirements, ear canal size and geometry, ease of insertion and manipulation, skin sensitivity, need for specific features (e.g. volume control, directional microphones, direct auditory input (DAI), telecoil), comfort, occlusion considerations, and cosmetic concerns.
  - HA style including
    - Bone Anchored Hearing Instrument (BAHA): These devices are recommended for clients with conductive/mixed hearing loss and unilateral deafness. It is noted that bone-anchored devices require collaboration between audiologist and otolaryngologist/otologist
    - CROS/ BiCROS/ transcranial: CROS and Bi CROS fittings are specifically designed for patients having either unilateral hearing loss or bilateral asymmetrical hearing loss where one ear is unaidable. Currently these hearing instruments are available in wired and wireless configurations and having either analog or digital signal processing

- Types of potentially unaidable ears: consider factors that would contraindicate amplification
- Monaural vs. Binaural fitting
  - Binaural amplification is recommended for most clients. However, monaural fittings may be warranted based on specific client needs and in particular cases of asymmetry, binaural interference, financial and/or cosmetic concerns. Contraindications to Binaural Hearing Instrument Fittings include: binaural interference, diplacusis, psychological factor and physical factors
- Additional considerations
  - DAI and telecoil circuitry
  - Microphone options
  - Number of memories
  - Number of frequency bands and channels.
  - MPO and OSPL 90
  - Digital Noise reduction
  - Digital feedback suppression/cancellation.

## **(7) Documentation**

- Client files should be maintained with appropriate chart notes related to the process of the selection of the hearing instruments and treatment planning
  - Client Order Agreement: To include make, model, of recommended hearing instrument being ordered, name of client and name and address of dispensing clinic, extra costs itemized (e.g., earmolds, ALDS, accessories or services). A statement concerning the instrument condition, (e.g., new, reconditioned, as is), specifics of hearing instrument warranty, return policies, non-refundable fees, follow up services, tangible goods that are included in the agreement, date the agreement was signed by both parties and the signatures of all parties involved in the agreement.

## **(8) Appendices**

### **Appendix B.1-Earmold Impressions**

- Instructions to Client
  - explanation of process, time expected, alert to vasovagal reflex, discomfort
- Otoscopic Exam
  - cleanses hands (and all equipment)
  - solid, balanced stance

- braces finger(s) against client's cheek/head to protect ear from harm due to unexpected movements
- assesses ear canal for any contraindications for taking an impression; assesses canal for size, length, and direction
- Insertion of Otoplast
  - selects appropriate size and type otoplast for ear canal
  - braces finger(s) against client's head to protect ear
  - inserts otoplast to appropriate depth (1st or 2nd bend) for type of instrument being fitted
  - examines otoplast placement with otoscope
- Mixing Material
  - material mixed according to manufacturer's specifications
  - measured amount blended uniformly
  - pacing for hardening
- Injecting Material
  - braces ear
  - fills canal and concha fully, without distorting ear (eg from pulling pinna, packing in concha, etc.)
- Removal of Material
  - waits appropriate amount of time for material to set-up; test for hardening
  - releases pressure to avoid negative pressure problems
  - twists impression forward to release pressure and remove
- Final check
  - otoscopic exam
  - critique acceptability of impression (seated to otoplast, sufficient length, uniform edges, no gaps or air bubbles).

## **C. FITTING and VERIFICATION (including Quality Control and Servicing)**

### **(1) Focus**

- To ensure that hearing instrument(s) meet reasonable and expected quality standards prior to an adult client hearing instrument fitting
- To ensure that evidence-based standards are followed for the verification of hearing instrument(s) fittings for adults
- To ensure that the fitting and verification process culminates in an optimal hearing instrument fitting
- To ensure that the verification process serves as a benchmark against which future hearing instrument changes can be made.

## (2) Background

Real Ear Measurement systems provide an efficient and objective means of verifying hearing instrument fittings before the wearer leaves the office. Real ear probe microphone measurements can be used to verify acoustic and electroacoustic modifications as well as evaluate the need for repairs. (Mueller et al., 1992).

Anecdotal reports from a number of investigators [Todd Ricketts, Michael Valente, *et.al.*] have indicated that approximately 10-15% of new hearing instruments may be defective in some way upon receipt. Some problems or defects reported are fairly obvious problems, such as dead or intermittent instruments due to dead microphones or receivers and highly distorted sound quality due to faulty receivers. Among the less obvious faults reported are problems such as directional microphones wired backwards (or not wired at all) and bilateral instruments with directional microphones wired 180 degrees out of phase. Quality control measures are therefore necessary prior to fitting in order to reduce client and practitioner frustration and inconvenience.

Specific goals and rationales underlie all hearing instrument fittings. Verification will ensure benefit to the client is derived from each hearing instrument fit. Verification procedures should be based on validated hearing instrument fitting rationales as supported in the hearing instrument selection section of this document. In the verification process, a signal must be presented to the hearing instrument, whether it is being tested with a microphone in the test chamber or with a probe microphone in the real ear. The clinician must select test signals that will ensure accurate verification. Recent investigations have illustrated that various types of signal processing features (compression, noise reduction, feedback reduction, etc.) can and do interact with the test signal and that the most accurate representation of the hearing instrument's response will be through the use of a speech-like signal. Additionally, the clinician can (and in some instances should) turn off signal processing features that attempt to reduce output that is considered "noise" by the signal processor during testing. Consequently, when attempting verification of prescriptive methods for which the targets are based on speech inputs, a speech-like signal should be used. This may require that the test signal adequately represents the frequency, intensity, and temporal aspects of speech.

Among the tools that may be used in the fitting and verification processes are:

- Prescriptive formulas for hearing instrument gain and output
- 2cc coupler measures (including RECD and REDD measures)
- Real ear measurements
- Sound field measures

- Circum-aural or insert earphone measures (for deep-insertion hearing instruments, such as the Lyric hearing instrument)
- Outcome measure questionnaires.

### **(3) Definitions**

(a) "**adapt**" or "**modify**" means to change the physical characteristics of a hearing instrument, earmold, or other attachment. (e.g. tubing, earhooks, shells or venting);

(b) "**adjust**" means to program or change the electroacoustic parameters, functions, or features of a hearing instrument or attachments in order to meet the requirements of an individual's hearing loss, needs and preferences;

(c) "**fitting**" means dispensing a hearing instrument (new, repair or remake);

(d) "**prepare**" means prior to a fitting session to ensure that the hearing instrument was received as ordered, perform a listening check, and ensure that the manual switches, controls, features, etc. are working;

(e) "**select**" means to choose a hearing instrument with the electroacoustic response, features, and functions that meet an individual's hearing, physical, and lifestyle requirements;

(f) "**verify**" means to measure a hearing instrument's electroacoustic performance compared to a standard. Verification is the act of measurement and may include both objective and subjective measures. For example, objective verification of performance may be compared to an ANSI 2cc coupler standard or to a prescriptive target formula in a real ear. Verification may also include subjective measures of sound quality or sound level, or assessment of comfortable fit and cosmetic appeal. Real ear measurements are the preferred method of objectively verifying hearing aid performance.

### **(4) Expected Outcomes/Objectives**

- Hearing instrument(s) shall meet manufacturer's published specifications when tested in a standard coupler(measurements performed according to ANSI-S3.22-1996b or current standard)
- All switches, controls and features shall function as specified by the manufacturer or as required by the client
- Hearing instrument(s) and earmolds shall yield a comfortable physical fit
- Each hearing instrument fitting shall be verified to ensure that the instrument is able to make soft sounds audible, maintain comfort for moderate/medium level sounds (*e.g.*, conversational speech), and prevent loud sounds from becoming uncomfortably loud
- Each hearing instrument fit shall be able to provide adequate gain (see definitions) meet prescribed target responses for gain and output (dependent on prescription method chosen)
- To provide a reference against which future hearing instrument electroacoustic output may be measured

NOTE: if instruments cannot be programmed or set to provide adequate gain, a clinical note must be entered in the client's file.

## **(5) Indications for Use**

- New hearing instrument(s) received from the manufacturer to be fit to an adult client (*adult clients age 16 years or older*)
- Hearing instrument(s) received from the manufacturer following repair or remake or re-plate.

**(6) Assessment** - See Procedures/Methods and Appendices.

## **(7) Procedures/Methods**

### 7.1 Quality Control

- Perform electroacoustic analysis to ensure hearing instrument(s) (both new and remade) meet manufacturer specifications or that instrument(s) settings have been restored to previous user settings. Hearing instrument(s) shall meet manufacturer's published specifications when tested in a standard coupler (measurements performed according to current ANSI standards). Coupler measures should include measures of gain, frequency response, maximum output, battery drain, and distortion must conform to manufacturer specification within tolerance
- Prepare the hearing instrument(s) and perform listening check accomplished via a listening tube or other coupling device to confirm that hearing instrument(s) are not intermittent, do not have excessive circuit noise, and are operating without significant distortion or excessive internal noise and that volume controls, switches, microphones, telephone coils, etc. are functioning
- Perform initial programming of selected hearing instrument(s) to client data/needs and to ensure integrity of hearing instrument(s) and programming software.

### 7.2 Fitting or Follow up

- Ensure appropriateness of physical fit for client by assessing ease of insertion and removal, absence of feedback, cosmetic appeal, absence of sharp or rough edges, and overall physical comfort
- Modify shell or earmold as required to achieve comfortable fit
- Ensure that the client or family member/caregiver can manipulate the hearing instrument(s) controls and switches appropriately
- Provide instructions and written information (where appropriate and available) on special features (directional microphones, automatic and manual memories, T-coils, Bluetooth capabilities, etc.), battery use and expected life, and an agreed upon wearing schedule
- Modify venting as required to reduce occlusion effect or to control feedback

- Adjust hearing instrument(s)'s response based on verification measures or client feedback or both
- Since even small programming adjustments to hearing instrument gain and output can result in significant acoustic output changes, it is recommended that any adjustment be documented by real ear measurements in addition to subjective client report of satisfaction
- Obtain objective measurement of verification (in the ear or 2cc coupler) that benefit is derived from the hearing instrument(s). In order to determine that the hearing instrument(s) are performing for a client, real ear measures should be made unless contraindicated by physical limitations. See Mueller et al., 1992. These measures should confirm that audibility, comfort and tolerance of hearing instrument fit are appropriate (see definitions) for the client
  - Audibility for soft input (50 dB SPL) should be ascertained via Real Ear Aided Response and/or sound field thresholds and/or circum-aural or insert earphones
  - Comfort of amplification should be verified so that average input to the hearing instrument(s) is judged as "comfortable". Real Ear Insertion Gain should be measured at 65 dB SPL. A soundfield speech signal at 60-65 dB SPL should be used to assess comfort of hearing instrument output and/or circum-aural or insert earphones
  - Tolerance should ensure that high level input to the hearing instrument(s) will not exceed threshold of discomfort. A Real Ear Saturation Response with the hearing instrument(s) at user gain with a 90 dB SPL swept pure tone input should be measured. Threshold of discomfort must not be exceeded at any frequency. Alternatively, use of RECD measures (Moodie, Seewald, and Sinclair 1994) may be measured for a client and the coupler to earphone transformations added to the OSPL in the coupler to "predict" the RESR across frequencies. If soundfield is used to assess tolerance a speech signal presented at 80-85 dB SPL must be used to elicit a subjective response of "loud but OK".

### 7.3 Servicing

- In-office
  - Client or family member/caregiver are to be advised that occasional, in-office maintenance of hearing instrument(s) may be required, including removing debris from receiver and microphone ports, cleaning, corrosion from battery contacts, replacing earmold tubing or battery doors, and other minor tasks
  - A listening and electroacoustic check of each hearing instrument should be done at each in-office servicing and kept as part of the clinical record
- Out-of-office

- Client or family member/caregiver are to be advised that repairs requiring the hearing instrument(s) to be sent to the manufacturer may be required from time to time
- Repaired, re-plated and remade hearing instruments to be verified (by real ear measurements or 2cc coupler measures).

## **(8) Documentation**

- Client files should be maintained with appropriate chart notes related to the process of fitting and verification
- Clinical notes are to be kept on file for each client and for each clinic visit or contact. Notes should contain at a minimum; a description of the issue/concern/problem or comment, the action(s) taken to address the issue/concern/problem or comment and an outcome (either verified or expected) or plan of action. Notes must contain sufficient information to allow an outside party to reconstruct what occurred at each visit or contact
- Results of verification of a fitting are to be kept; if results are recorded on thermal paper, a photocopy must be made, as thermal paper images will fade over time
- Measures completed for fitting verification of hearing instrument remake or repair are to be kept on file
- Notes on modifications to hearing instrument/earmold required to achieve target or comfort are to be recorded electronically or in paper format
- Notes are to be kept on file which record the client's hearing instrument serial number, date fit, warranty dates, options, as well as number of programs and function of controls
- Sales documentation to include make, model, serial number(s), name of client, name and address of dispensing clinic, extra costs itemized (e.g., earmolds, accessories or services), instrument condition (new, reconditioned, as is), specifics of hearing instrument warranty, return policies, non-refundable fees, follow up services, and dated with signatures of both parties.

## **(9) Client Monitoring**

Unless declined by the client or family member/caregiver, follow-up appointments are to be scheduled after fitting session. See Section 4.1 and 4.2, Hearing Instrument Orientation and Follow-Up.

## **(10) Client Education**

Ensure client receives descriptive material that describes the use, maintenance and operation of their hearing instrument(s), remote controls and any assistive devices which accompany the instrument(s). See Section 4.1 Orientation and Follow-up section of this guideline.

## **(11) Appendices**

Test Protocols for Probe-Microphone Measurements; Mueller, HG, (et al). (1992) *Probe Microphone Measurements*. San Diego: Singular Publishing Group, Inc. 1992: 269-278, Chapter 13. The following protocols are adapted from the above noted source. The reference noted above should be referred to prior to procedures. There may be some steps in each protocol that will vary depending on what real ear measurement equipment is employed and type of hearing instrument is being tested. The equipment operation manual should be consulted for aspects that are equipment specific.

### **a) Real Ear Unaided Response (REUR)**

- Equalize soundfield and calibrate probe tube
- Otoscopy to be completed prior to insertion of probe tube, and post insertion
- Place probe tube in ear canal 25 - 30 mm past the tragal notch
- Select stimulus type and intensity. It is best to select stimulus and intensity that will later be used for real ear insertion response (REIR) measurement. If above room the room noise floor, 60 dB SPL is acceptable
- Conduct measurement.

#### **Clinical Application:**

- Provides reference for the REIR measurement
- Can be used in selecting the appropriate 2cc coupler gain based on target real ear insertion gain (REIG); that is, the REUR is used to `customize `the conversion from prescribed REIG to 2cc coupler gain
- Unusual configuration could indicate tympanic membrane perforation, external of middle ear pathology, or excessive cerumen.

### **b) Real Ear Instrumented Response (REAR) as part of the Real Ear Insertion Response (REIR)**

- Keep probe tube at same location in ear canal as was used for REUR measurement
- Place hearing instrument on the client and adjust volume control wheel (VCW) to desired position if applicable
- Select same stimulus and intensity as used in REUR measurement
- Conduct measurement and repeat until desired response is obtained

#### **Clinical Application:**

- Serves as instrumented response from which the REIR is derived
- Serves as indication of amplified sound pressure level (SPL) in the ear canal for a given input level.

### **c) REAR as part of Amplified Speech Spectrum Approach**

- Equalize soundfield and calibrate probe tube
- Otoscopy to be completed prior to insertion of probe tube, and post insertion

- Place probe tube in ear canal 25 - 30 mm past the tragal notch
- Select stimulus type and intensity. Speech weighted noise at 70 dB SPL best represents typical inputs
- Place hearing instrument on client and adjust VCW to desired position
- Conduct measurement and repeat until desired response is obtained, that is, targets for the amplified speech spectrum are most closely approximated.

**Clinical Application:**

- Used to adjust the hearing instrument to make speech audible and at desired sensation levels (DSLs).

**d) Telecoil REAR Response using input from telephone**

- Disable loudspeaker, either through the system's software or by manually unhooking wires leading to loudspeaker. Ready system to measure a signal.
- Place probe tube in ear canal 25 - 30 mm past the tragal notch
- Place hearing instrument on the client and set to T to activate telecoil
- Adjust VC to full on
- Connect two telephone lines within the clinic (use one line to call another)
- Route speech noise from audiometer earphone at 60 dB HL to the transmitting telephone, which is received by the other telephone, located near the probe microphone equipment
- Place headset of receiving telephone at desired position near the hearing instrument; rotation of headset may be required to obtain most output
- Conduct measurement

**Clinical Application:**

- Determine if telecoil response is appropriate
- Allows comparison of one telecoil response to another
- Allows comparison of one telephone to another
- Determines the effects of telephone-amplifying systems
- Determines sensitivity of the telecoil as a function of positioning of the headset.

**e) REAR of an Assistive Listening Device (ALD) or FM system**

- To be addressed in a separate practice guideline.

**f) Real Ear Insertion Response (REIR)**

- Equalize soundfield and calibrate probe tube according to the equipment manufacturer's manual
- Otoscopy to be completed prior to insertion of probe tube, and post insertion
- Place probe tube in ear canal 25 - 30 mm past the tragal notch
- Select stimulus type and intensity.
- Complete REUR and REAR as described earlier

- REIR is typically automatically displayed by subtracting the REUR from the REAR
- Make adjustments using software, VCW, venting and so on. Repeat measurements until best match to target REIG values is obtained

**Clinical Application:**

- Provides verification of target REIG values
- Determines acceptability of hearing instrument gain and frequency response.

**g) Real Ear Saturation Response (RESR)**

- Equalize soundfield and calibrate probe tube
- Adjust hearing instrument output control to minimum SSPL90 setting
- Place hearing instrument on client and adjust VCW to highest position before feedback or projected use setting if hearing instrument has input compression
- Select swept pure tone or warble tone signal at 85 or 90 dB SPL (85 dB SPL is the recommended level for real-ear verification of output).
- Conduct measurement, curve will represent minimum RESR for the instrument
- Increase SSPL90 control and repeat measurement until desired RESR is obtained

**Clinical Application:**

- Determines the maximum SPL the hearing instrument is capable of delivering to the user's ear
- Allows proper adjustment of SSPL90
- Provides information relevant to concerns about over amplification
- Provides documentation for any litigation concerning over amplification.

**h) Real Ear and 2 cc coupler Loudness Discomfort Levels (LDLs)**

- Calibrate the probe tube if necessary
- Disable loudspeaker, either through the system's software or by manually unhooking wires leading to loudspeaker. Ready system to measure a signal.
- Otoscopy to be completed prior to insertion of probe tube, and post insertion
- Place probe tube in ear canal 25 - 30 mm past the tragal notch
- Place a portable audiometer with ER-3A earphones next to the probe-microphone system
- Using a foam insert, put the ER-3A on the client's ear (probe tube can be threaded through the foam to help maintain proper position in the ear canal).
- Obtain LDLs for pure tones at 500, 1000, 2000 Hz and 3000 Hz
- At the determined point of loudness discomfort at each frequency, turn the pure tone on continuously and measure the SPL in the ear canal at the LDL
- Record the LDLs in dB HL and convert to dB SPL in a 2cc coupler. These conversions are obtained by calibrating the ER-3A in an HA-1 2cc coupler; for instance, if 70 dB HL on the audiometer dial produces 75 dB SPL in the 2cc coupler, then 5 dB is added to the earphone dB HL LDL to give the LDL in 2cc dB SPL

**Clinical Application:**

- Provides target 2cc coupler SSPL90 values based on LDLs for use in selecting behind the ear hearing instruments or ordering in the ear hearing instruments
- Provides target RESR values for use in adjusting the output control and setting the SSPL90 at the hearing instrument fitting.

**i) Predicted Real Ear Saturation Response (RESR)**

- Equalize soundfield and calibrate probe tube
- Otoscopy to be completed prior to insertion of probe tube, and post insertion
- Place probe tube in ear canal 25-30 mm past tragal notch
- Place hearing instrument on client and adjust VCW to a mid position if applicable
- Obtain REAR with a 60 -70 dB SPL signal
- Without changing the VCW, remove the hearing instrument and measure the 2cc coupler output using the same input intensity as was used for the REAR
- Obtain a real ear to coupler difference (RECD) by subtracting the 2cc response from the REAR
- Turn the VCW full on and measure an SSPL90 curve in the 2cc coupler
- Add the RECD to the 2cc coupler SSPL90 curve, the result is the predicted RESR

**Clinical Application:**

- Determines the maximum predicted SPL the hearing instrument is capable of delivering to the users ear
- Allows proper adjustment of SSPL90
- Provides information relevant to concerns about over amplification
- Provides documentation for any litigation concerning over amplification.

**j) Real Ear Occluded Response (REOR)**

- Equalize soundfield and calibrate probe tube
- Otoscopy to be completed prior to insertion of probe tube, and post insertion
- Place probe tube in ear canal 25-30 mm past tragal notch
- Conduct REUR measurement
- Place hearing instrument and earmold in the ear with the hearing instrument turned off
- Conduct measurement using the same input intensity as was used for the REUR
- Compare REOR to the REUR and the input level used

**Clinical Application:**

- Determines the degree that the hearing instrument and earmold is attenuating direct input sound, that is, is venting allowing sound to pass through at desired frequencies
- Determines if increased gain is present in the lower frequencies due to vent resonance.

### **k) Occlusion Effect caused by hearing instrument or earmold**

- Disable loudspeaker, either through the system's software or by manually unhooking wires leading to loudspeaker. Ready system to measure a signal
- Otoscopy to be completed prior to insertion of probe tube, and post insertion
- Place probe tube in ear canal 25 - 30 mm past the tragal notch
- Have client vocalize a vowel such as /ee/
- Have client monitor vocal intensity by observing a sound-level meter
- When client sustains vocalization at a desired level, for example, 80 dB SPL at 12 inches, measure SPL in the unaided ear canal
- Place hearing instrument and earmold on the client with the hearing instrument turned off. Repeat the measurement
- Compare the difference between the two measurements, which is the occlusion effect

#### **Clinical Application:**

- Determines if a hearing instrument or earmold is causing an occlusion effect for the client's voice
- Determines if alterations in venting or canal length reduce the occlusion effect.

### **l) Real Ear Coupler Difference (RECD)**

- Equalize soundfield and calibrate probe tube
- Otoscopy to be completed prior to insertion of probe tube, and post insertion
- Place probe tube in ear canal 25-30 mm past tragal notch
- Place hearing instrument on client and adjust VCW to a mid position if applicable
- Obtain an REAR with a 60 -70 dB SPL signal (level is important only in that the hearing instrument should not be in saturation)
- Remove the hearing instrument without changing the VCW
- Measure the output of the hearing instrument in the 2cc coupler with the same input intensity as used in the REAR measurement
- Subtract the 2cc coupler output from the REAR producing the RECD

#### **Clinical Application:**

- Can be used in selecting the appropriate 2 cc coupler gain based on target REIG, that is, the RECD can be used to customize the conversion from prescribed REIG to 2cc coupler gain
- Can be used in obtaining the predicted RESR

### **m) Determining desired 2 cc coupler gain through use of customized correction values (CORFIGs)**

- Equalize soundfield and calibrate probe tube
- Otoscopy to be completed prior to insertion of probe tube, and post insertion
- Place probe tube in ear canal 25-30 mm past tragal notch

- Measure the REUR
- Place hearing instrument on the client, preferably the type that will be selected or ordered, and set the VCW to a mid position if applicable
- Measure the REAR and thus determine the REIR
- Remove the hearing instrument and, without changing the VCW position, measure the 2cc coupler gain with the same input intensity as used in the REAR
- Subtract the REIR from the 2cc coupler gain, thus providing the customized CORFIG
- Add the CORFIG to the prescribed target REIG values, yielding the desired 2cc coupler gain at user VCW position
- Add 10 dB for reserve gain; the resulting values will be the desired full on 2cc coupler gain

**Clinical Application:**

- Customizes the 2cc coupler gain order to optimize the chances of obtaining the prescribed target REIG.

**n) Additional considerations for verification of open fits, or instruments with large vents:**

- Verification must be conducted using real ear measurements, not coupler measurements
- The reference microphone of the real ear test system must be disabled during measurement, according to the procedure specified by the manufacturer of the real ear system.
- Reference article reprinted with permission and copyright AudiologyOnline: Brown M (2008). Evaluating the performance of digital hearing instrument features: A real-world approach. Retrieved from [http://www.audiologyonline.com/articles/article\\_detail.asp?article\\_id=2046](http://www.audiologyonline.com/articles/article_detail.asp?article_id=2046).

## **D.1 HEARING INSTRUMENT ORIENTATION**

### **(1) Focus**

To ensure that the client/family member/ caregiver:

- Is able to physically insert and remove the instrument(s)
- Is able to manipulate all switches, controls and buttons on the instrument(s)
- Knows when to and is able to change batteries
- Understands basic care and maintenance of the instrument(s)
- Understands the potential benefits and limitations likely to be provided by the instrument(s)
- Has a general understanding of the process ahead.

## **(2) Background**

Research has shown that an effective orientation program can significantly reduce hearing instrument returns, while providing increased use, benefit and satisfaction. The orientation process begins with the initial fitting and may continue over several visits. Because of the amount of information presented, it should be provided in both a written and oral format. Orientation is usually more effective if at least one family member or caregiver is also involved in the sessions. Orientation information can be categorized as “device-related” or “client-related.” “Device related” information is related specifically to the care and use of hearing instrument(s). “Client-related” information includes helping the client understand the nature of hearing loss, adjustment to amplification, realistic expectations of the benefits and limitations of amplification, and taking advantage of other sources of help (such as better communication strategies, Hearing Assistive Technologies (commonly called Assistive Listening Devices or ALD’s), and speech reading (lip reading). This information may be provided during hearing instrument orientation visits, as well as during long-term follow-up care.

## **(3) Definitions**

None.

## **(4) Expected Outcomes/Objectives**

- Client obtains benefit from treatment as easily and efficiently as possible
- Client or family member/caregiver (or both) are provided with instructions in the use and maintenance of the hearing instrument(s), along with counselling for effective communication
- All client problems or concerns are addressed wherever feasible; if unable to address them, documentation must be provided as to why the issue could not be addressed
- Any problems with physical or acoustic discomfort (*i.e.*, soreness in ear, occlusion, excessive loudness, etc.) are either alleviated or minimized
- Any issues or concerns regarding dexterity or manipulation are addressed and either alleviated or minimized
- Client or family member/caregiver able to implement manufacturer’s recommended maintenance procedures
- Client or family member/caregiver knows and accepts realistic expectations regarding communication, including any limitations
- Knowledge of listening strategies that can be employed in various acoustic environments.

## **(5) Indications for Use**

- Client is being fitted with amplification
- Client or family member/caregiver report a problem with the function, comfort, or benefit being received from amplification
- When hearing instrument options or features are changed.

## **(6) Assessment**

Not applicable.

## **(7) Procedures and Methods**

- Unless the client declines appointments, experienced hearing instrument users shall be seen for at least one (1) appointment covering orientation and follow-up. New users shall be seen for at least two (2) appointments covering orientation and follow-up
- Face to face is the preferred delivery method for follow-up appointments. The College realizes that this may not always be feasible given distances to clinics and other variables. In cases where face to face follow up is not possible, such follow up services may need to be delivered via telephone or other telecommunication means
- The following device-related information should be provided to each client and ideally to at least one family member or caregiver, as part of the orientation process:
  - Demonstrate and verify that client or significant other can properly insert and remove the instrument(s)
  - Describe/explain hearing instrument features (multiple programs, telephone coil, directional microphone operation, direct audio input, connectivity to other devices, and other special features) and their expected, realistic benefits to the client
  - Describe/explain battery use, including size, how to change, disposal, purchase options, and expected battery life
  - Counsel client on care, cleaning and maintenance of instrument(s)
  - Verify that instruments are physically comfortable and minimize occlusion to fullest extent possible
  - Counsel client on management of feedback issues
  - Counsel client on telephone use including use with speaker phones, cell phones and the use of the telephone coil (if applicable)
  - Explain manufacturer warranties (and if applicable any clinic warranties) regarding repair, remake and Loss & Damage replacement

- The following “client-related” information should be provided to each client and ideally to at least one family member or caregiver, as part of the orientation process:
  - Explain reasons for acclimatization/adjustment and establish an agreed-upon wearing schedule
  - Counsel client on cerumen management
  - Counsel client on realistic goals and expectations, including any inherent limitations imposed by the impairment itself
  - Discuss adjusting to amplification in various settings, *i.e.*, family, social, school, work
  - Discuss environment issues, *e.g.*, restaurants, groups, movies and theatres, television, houses of worship
  - Discuss listening strategies, such as preferential seating, reducing background noise where possible, etc.
  - Explain benefits and limitations of monaural/binaural hearing instrument use
  - Discuss post-fitting care.

## **(8) Documentation**

Clinical notes (hand-written or electronic) are to be kept on file for each client and for each clinic visit or contact. Notes should contain at a minimum, a description of the issue/concern/problem, the action(s) taken to address the issue/concern/problem and an outcome (either verified or expected). Notes should be brief, but must contain sufficient information to allow an outside party to reconstruct what occurred at each visit or contact.

## **(9) Client Monitoring**

See Procedures and Methods section above.

## **(10) Client Education**

See Procedures and Methods section above.

## **(11) Appendices**

Appendix 4.1.

Research (Kochkin, *et.al.*, 2010) has shown that spending zero (0) hours on orientation and follow-up increases the probability of a client having lower-than-average success. Spending one (1) hour on orientation and follow up does not differentiate between those with lower-than-average success and those with higher-than-average success. However, spending two (2) or more hours on orientation and follow-up increases the probability that clients will experience greater-than-average success. Namely, they can be expected to:

- be less likely to put the instruments "in the drawer"
- use their hearing instruments more than 4 hours per day
- find more benefit in multiple listening environments
- find greater satisfaction with their instruments
- find greater reduction in handicap
- recommend hearing instruments and the provider to others

In view of these findings and similar finding from other researchers, the College recommends that at least two (2) hours be spent with patients on hearing instrument orientation and follow-up.

## **D.2 FOLLOW-UP**

### **(1) Focus**

To ensure that benefit and successful use of amplification continues not only throughout the acclimatization period, but also into the long term.

### **(2) Background**

The fitting of hearing instruments is not the end of the treatment process, but instead is the beginning. Comprehensive counselling is required to help the client adjust to his/her hearing instruments and to assist the client/family member/caregiver in developing appropriate strategies to maximize the assistance received from hearing instruments. Most adults live with their hearing loss for many years prior to seeking help and have often developed both good and bad behaviours to compensate for their hearing loss. The fitting of hearing instruments does not necessarily guarantee immediate communication success. Counselling is often required to help clients "unlearn" their bad compensatory behaviours and to learn new strategies to better help themselves. In addition, emotional factors concerning hearing loss must be addressed in a comprehensive program. The counselling and aural rehabilitation components of follow-up can be provided on an individual basis or in small group settings or a combination of the two.

Subjective surveys have shown that group adult counselling is perceived as beneficial in terms of reducing return rates for hearing instrument(s), increased use of HAT's/ALD's, fewer trouble-shooting visits, and increased referrals provided by satisfied users. Research has also demonstrated that clients participating in post-fitting follow-up programs show greater reduction in self-perceived handicap, improved Quality of Life [QOL] ratings, and improvement in communication function compared to clients who received hearing instruments alone.

Limited research evidence suggests that short-term benefit in adjusting to the instrument(s) and reduction in handicap can be achieved with fairly minimal counselling of approximately two (2) hours or so in total. It is not yet clear if this short-term benefit can be maintained over the long term without more extensive counselling. For example, there is some evidence that long-term benefit is equal between groups of clients

who receive extensive counselling and those who receive lesser amounts of counselling. Evidence also suggests that the participation of spouses and significant others can be an important contributor to success.

### **(3) Definitions**

None.

### **(4) Expected Outcomes/Objectives**

- To provide effective implementation of strategies to reduce the effects of hearing loss
- To help clients adapt to the use of amplification or other assistive listening devices
- To establish procedures for follow-up
- To provide information to allied health-care professionals
- To provide information about assistive and alerting systems.

### **(5) Indications for Use**

- Individuals who have had their hearing evaluated
- Individuals who need more help than their hearing instruments can provide
- Individuals who have been fitted with amplification.

### **(6) Assessment**

- Puretone check recommended every 2 years
- Individuals reporting changes to hearing or hearing instrument benefit should be considered for re-evaluation (hearing assessment) on an as-needed-basis based on clinical judgement.

### **(7) Procedures and Methods**

- Formulate treatment program (both short-term and long-term) and counsel client on importance of follow-up visits
- Post-fitting counselling and follow-up should be provided to new hearing instrument users and to experienced users who have not received these services, or who may want a “refresher” course
- Clients should be informed that the full benefits of amplification may not be immediately apparent and that there will probably be a period of adjustment or acclimatization to allow for neural plasticity
- The client’s primary communication partner(s) or significant other should be included
- Counselling and follow-up may be provided in either a group or individual setting, or a combination of both
- Instruct client/significant other on effective listening techniques with hearing instruments
- Counsel family members about client’s adjustment to and use of hearing instruments
- Where appropriate, include demonstration and information on HAT’s/ALD’s

- Provide client with information on benefits and limitations of speechreading or other aural rehabilitation classes
- Reprogram or adjust hearing instrument settings as required to reflect changes in client's hearing sensitivity or subjective preference and lifestyle needs
- Additional topic areas that may be addressed during follow-up (may also be introduced as part of the orientation)
  - Basic anatomy and physiology of hearing, including tinnitus and (if appropriate) balance problems
  - Understanding the audiogram
  - Appropriate and inappropriate hearing and listening behaviours
  - Listening and repair strategies
  - Controlling the environment
  - Assertiveness
  - Realistic expectations
  - Stress management
  - “Helpful hints” for communicating with spouse
  - “Helpful hints” for spouse communicating with client
  - Community resources.

### **(8) Documentation**

Clinical notes are to be kept on file for each client and for each clinic visit or contact. Notes should contain at a minimum, a description of the issue/concern/problem, the action(s) taken too address the issue/concern/problem and an outcome (either verified or expected). Notes should be brief, but must contain sufficient information to allow an outside party to reconstruct what occurred at each visit or contact.

### **(9) Client Monitoring**

See Procedures and Methods above.

### **(10) Client Education**

See Procedures and Methods above.

### **(11) Appendices**

None.

## E. OUTCOME MEASURES

### (1) Focus

To ensure that the treatment provided by the use of hearing instrument(s) produces an improvement in function compared to the unaided condition.

### (2) Background

Research has shown that positive client outcomes are strongly correlated to incorporating one or more outcome measures into a routine clinical protocol and that those outcome measures need to match the treatment goals. It is not sufficient to merely ask the client how they are doing. It is not the intent of this standard to mandate which specific outcome measures are to be used but, rather to describe some of the standardized and psychometrically sound measures that are available for the clinician to choose from. Outcomes can be measured in different domains such as Benefit, Activity Limitation or Participation Restriction (often previously referred to as 'Handicap') and Satisfaction and they can be measured either objectively or subjectively.

**Measures of Benefit** - In real world conditions, the activity of speech understanding and the participation in events that require speech understanding are heavily influenced by contextual factors related to both the environment and the client. Because of this complexity, objective outcome measures tend to be limited to measures of improved speech intelligibility when using amplification. They can be measured either in quiet or in background noise, using either sentences or single words. Because these measures compare aided to unaided performance, they are considered measures of benefit. Among the objective tests available in this domain are the Speech Perception in Noise test (SPIN and revised SPIN), the Hearing In Noise Test (HINT), the Quick Speech-In-Noise test (Quick-SIN) and measures of monosyllabic word recognition in background noise. There are also subjective measures of Benefit available, with two of the most commonly used tests being the Abbreviated Profile of Hearing Instrument Benefit (APHAB), and the Client Oriented Scale of Improvement (COSI).

**Measures of Activity Limitation or Participation Restriction** - Because the impact of a hearing impairment on a client in the areas of communication functioning, activity limitation, and participation restrictions cannot be easily measured objectively, subjective outcome measures, in the form of disease-specific questionnaires have been developed. Examples include the Hearing Handicap Inventory for the Elderly (HHIE) and the Hearing Handicap Inventory for Adults (HHIA). It may be important to measure treatment outcomes in terms of their impact on our client's perceived health-related quality of life (QOL), which are typically measured through the use of generic functional health questionnaires such as the Medical Outcome Survey Short Form 36 (MOS SF-36) or the Sickness Impact Profile (SIP). These questionnaires are designed to elicit responses to questions pertaining to general health, independence, pain, and depression. Unfortunately, such general measures of functional health status are often insensitive to the impact of

hearing loss. However, a recent study which utilized the World Health Organization's Disability Assessment Schedule (WHO-DAS II) as a generic quality of life outcome measure demonstrated that the WHO-DAS II is, in fact, sensitive to hearing instrument use.

**Measures of Satisfaction** - Practitioners may also want to look beyond the specific functional benefits of amplification to the more global domain of satisfaction, which includes dimensions such as cost, expectations, perceived value, comfort, and service. The Satisfaction with Amplification in Daily Life (SADL) test is one example of such a measure. A small percentage of dispensing professionals have also used some questions from Kochkin's extensive MarkeTrak survey questions as a measure of satisfaction. The advantage of this approach is that individual satisfaction ratings can be directly compared to a well established national data regarding hearing instrument satisfaction.

**Multimodality Measures** - There are several outcome measures that address multiple hearing instrument outcome domains (benefit, satisfaction, QOL) within a single questionnaire. Examples of such "omnibus" measures include the Glasgow Hearing Aid Benefit Profile (GHABP) and the International Outcome Inventory – Hearing Aids (IOI-HA). The IOI-HA promises to be a particularly effective measure due to its ease of administration (7-items), well-researched psychometrics and its translation into several languages.

As critical as it is to measure the benefits of treatment at the level of the client, the measurement of treatment outcomes is assuming greater importance on the national healthcare stage. Through the routine use of clinically applied outcome measures and carefully controlled clinical trials, practitioners can build a foundation for evidence-based clinical practice guidelines. Clinical practice guidelines, in turn, minimize variability in outcome, maximize treatment efficacy, reduce risks, decrease waste, improve client satisfaction, and should help to elevate the awareness of professionals among third-party payers, other healthcare providers and, most importantly, current and future clients. As practitioners continue to compete in the health-care marketplace; they must demonstrate that treatments reduce activity limitations, decrease participation restrictions, and improve health-related quality of life. Only by measuring the outcomes can Audiologists and Hearing Instrument Practitioners be assured that treatments make a difference and clients have benefited from their care.

### **(3) Definitions**

Note: Impairment, Activity Limitation, and Participation Restriction are the formal terms used by the World Health Organization International Classification of Functioning. The definitions provided are the WHO definitions.

**Impairment:** problem in body function or structure such as a significant deviation or loss (e.g., elevated pure tone thresholds).

**Activity Limitation:** difficulty an individual may have in executing activities (e.g., listening in noise).

**Participation Restriction:** problems and individual may experience in involvement in life situations (e.g. no longer goes to large group social situations).

**Benefit:** refers to improvement from the unaided to aided condition. (e.g., improved word recognition in noise; higher self-reports of quality of life).

**Satisfaction:** subjective measurement of how 'happy' or 'pleased' a client is with the hearing instrument fitting.

#### **(4) Expected Outcomes/Objectives**

- Validate that client's treatment goals have been met
- Assess how well treatment has reduced activity limitations, decreased participation restrictions, and improved the client's quality of life [QOL].

#### **(5) Indications for Use**

- Client has been fitted with new hearing instrument(s) and has been using them for at least two (2) weeks
- Client expresses dissatisfaction with current hearing instrument(s).

#### **(6) Assessment**

#### **(7) Procedures and Methods**

- At least one validation/outcome measure, (e.g., one of those noted above), shall be administered to every individual fitted with hearing instruments within 2-6 weeks of fitting
- Outcome/validation measures may be administered to current hearing instrument users as recommended by the clinician.

#### **(8) Documentation**

Clinical notes are to be kept on file regarding the administration of any formal or informal outcome/validation measure. When administering a formal outcome/validation measure, a copy of those measurement results must be kept in the client's file.

#### **(9) Client Monitoring**

See Procedures and Methods above.

#### **(10) Client Education**

See Procedures and Methods above.

## **(11) Appendix**

### Appendix 5.1

Research has shown that outcome measures are an important (perhaps crucial) element of a hearing instrument fitting protocol and there is widespread agreement that they should be obtained approximately 2-6 weeks post-fitting. Unfortunately, outcome/validation measures don't appear to be obtained nearly as often as would be desired. Kochkin, et.al.,( 2010) have shown that hearing instrument wearers with above-average success are much more likely to have been given an objective or subjective measure of benefit (or both) and also a subjective measure of satisfaction. In the MarkeTrak VIII survey, approximately 79% of those with above-average success were given an objective measure of benefit, compared to only 53% of those with below-average success [26% differential]. Subjective measures of benefit were obtained for 32% of those with above-average success, but for only 7% of those with below-average success [25% differential]. Subjective measures of satisfaction were obtained on 23% of those with above-average success, but only on 6% of those with below-average success [17% differential]. Best practices would therefore suggest that clinicians should administer both an objective and subjective measure of benefit, along with a subjective measure of satisfaction to each client fit with hearing instruments. That being said, it may not always be possible to administer three (3) outcome/validation measures on each client. The particular outcome/validation measures obtained are left to the discretion of the professional.

## **E. RELATED DOCUMENTS**

College of Speech and Hearing Health Professionals of BC, Bylaws (2009), [www.cshhpbcc.org](http://www.cshhpbcc.org).

Government of British Columbia, Health Professions Act (2008), Victoria, BC: Queens Printer, [www.bclaws.ca](http://www.bclaws.ca)

Infection Prevention and Control Guidelines for Audiology, Interorganizational Group for Speech-Language Pathology and Audiology (2010), <http://www.cshhpbcc.org/publications.htm>.

QA Policy QA-03: Framework for Practice - Code of Ethics, Practice Standards, Decision Support Tools

QA Policy QA-05: Hearing Instrument Fitting for Adults