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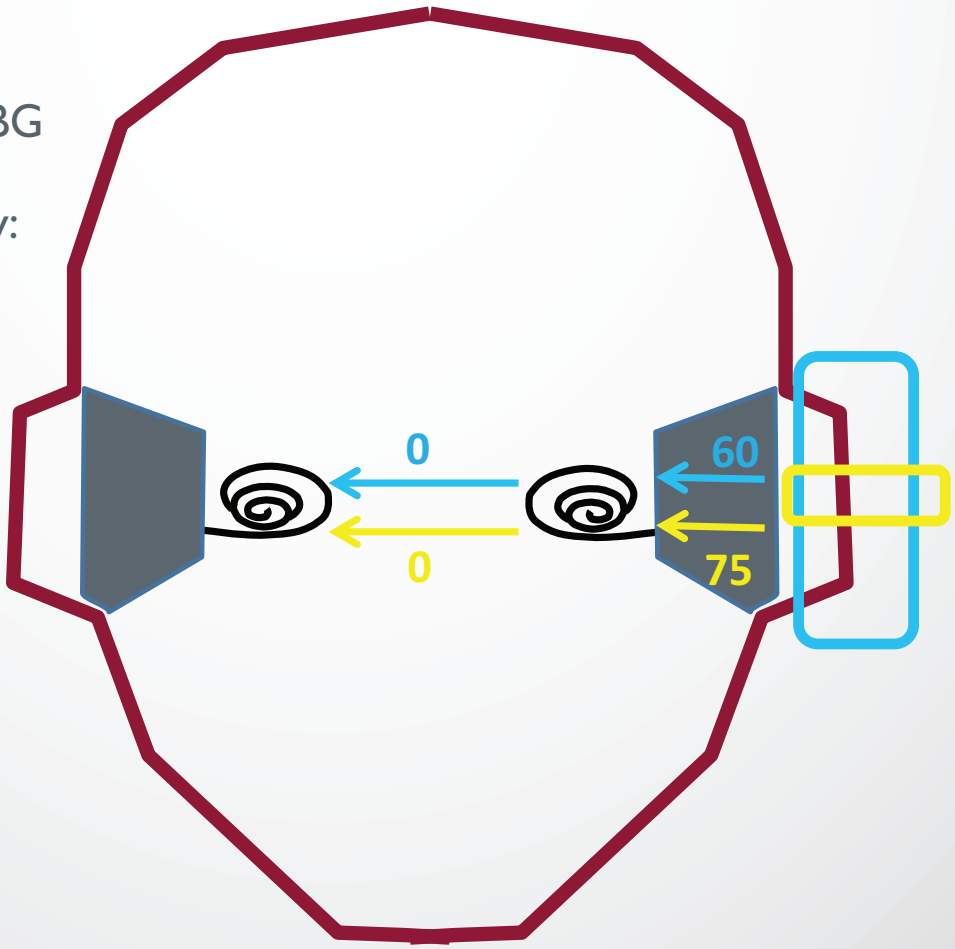
Why the IA Limits the ABG

Clinics Today vs. Yesterday: Are they Better?

Selling Your Business?



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We're having Fun, right? By "we," I mean both the Aud & the HIP. Here's to you! This issue has an eclectic assortment of articles, but we haven't diverted from our "prime directive," as stated in the last issue. In keeping with that, we shall continue to examine clinical corners that we tend to scoot around far too quickly. As a result, these corners become dusty. When this happens, we cannot answer what we as clinicians, *should* be able to answer.

An example of one of these clinical corners is encountered when we examine the fact that the *maximum degree of Conductive hearing loss (CHL) is not something etched in stone. It depends entirely upon the transducer used to measure it!* This begs the question as to what would really be the maximum degree of Conductive hearing loss. That aside, the relationship between circum-aural vs insert headphones & the maximum measurable CHL is best understood when we look at masking, and inter-aural attenuation (IA). Let's look closer here. We all know there are different criteria for when we need to use masking, with circum-aural vs insert headphones. Do we all know or appreciate however, how or why these different masking criteria are directly related to the maximum degree of Conductive hearing loss that we can measure with circum-aural vs insert headphones? I'll bet not. In fact, I didn't myself until one day when Shane Moodie (Audiologist at Western in London Ontario) alerted me to the fact. He said, "You've got a PhD, you should know that!" He was right.

Dr. Robert Turner (he calls himself Bob) has written an article for this issue that will enlighten those of us who don't know, and will reassure those who already do know. In 2004, he wrote a pair of back-to back articles in the Journal of the American Academy of Audiology called Masking Redux 1 and Masking Redux II. He was explaining an alternative "optimized masking method," but one paragraph in the 1st of his two articles caught my eye and made me remember my encounter with Shane. It was precisely about IA and how it relates to measuring CHL. I emailed Dr Turner this past summer and asked him if he'd write a short article about just that. He said "Yes," and so here 'tis. As I used to hear at the supper table, help yourself, it's good for you.

In other news, Unitron (my old stomping ground) has announced that it is opening an office in Brazil! That's a happening country. It happens to be almost as large as Canada but has just a few (200 million) more people. Two more authors make contributions here, Dr. Bob Martin and Adam Perrie HIS. They both share something in common; common sense. In his blog, Bob Martin cautions against describing features instead of benefits and doing so, one step at a time. Adam Perrie has re-written an article he wrote for the Signal a while ago, about selling a private practice; some do's and don'ts.

Now we all know about noise pollution, and that we have standards specifying excess noise exposure that causes Noise Induced Hearing Loss…Do we also know however, that our standards do not specify much about noise exposure for people wearing headphones? Tim Kelsall writes about exactly this, and also provides a convenient and relatively simple method whereby to estimate noise exposure while wearing headsets. OK, the last thing I will mention here is my own diatribe (read "whine") on clinic today vs yesterday. My career has had bookends. Back in 1988 I began three years of work as a clinical audiologist at The Canadian Hearing Society in Toronto ON. Just last year from 2013-2-14, I was once again a clinical audiologist at NexGen Hearing in Victoria BC. The bulk of years in between 1990 and 2013, were spent mainly in teaching. There's a saying: Those who don't do it, teach. Wow, did I ever find a change! Those who know me, know that I love to rant, and ranting is what I do in my article here. Forgive me. I just had to.

John Updike wrote a novel called "Rabbit Redux." Turner wrote two articles called "Masking Redux." Try saying "redux." Did you say it correctly?

Ted Venema, Editor-in-Chief

Canadian Hearing Report 2014;9(5):3.

UNITRON ESTABLISHES COMPANY OFFICE IN SÃO PAULO, BRAZIL PURSUES GREATER CUSTOMER INTIMACY AND MARKET EXPANSION

Unitron, a global innovator of advanced hearing solutions, has established a new company office in São Paulo, Brazil in order to pursue significant market expansion opportunities present within the country, as well as the benefits from working directly with its longstanding Brazilian customer base. The move concludes a 20 year distributor relationship in the country.

"So much of what we do today is focused on helping our customers realize growth within their hearing healthcare practices," said Jan Metzdorff, President at Unitron. "Establishing a company office will not only allow us to grow our share of the Brazilian market, but will strengthen our position to support existing customers in their pursuit of business success."

The Unitron team in Brazil will be led by Luiz Eringer, an industry expert who has been working within the Sonova Group since 2005.

"Brazil is an important and underserved market," said Luiz Eringer, General Director of Sales, Unitron Brazil. "Currently, only one in 20 people with hearing loss wears a hearing aid in our country. This is four times lower than the average rate in Europe or North America. There is much work to do to ensure Brazilians get the hearing help and support they need."

Canadian Hearing Report 2014;9(5):4.

HEARING PROTEIN REQUIRED TO CONVERT SOUND INTO BRAIN SIGNALS

A specific protein found in the bridge-like structures that make up part of the auditory machinery of the inner ear is essential for hearing. The absence of this protein or impairment of the gene that codes for this protein leads to profound deafness in mice and humans, respectively, reports a team of researchers in the journal EMBO Molecular Medicine.

"The goal of our study was to identify which isoform of protocadherin-15 forms the tip-links, the essential connections of the auditory mechanotransduction machinery within mature hair cells that are needed to convert sound into electrical signals," remarks Christine Petit, the lead author of the study and Professor at the Institut Pasteur in Paris and at Collège de France.

The researchers engineered mice that lack only the CD2 isoform of protocadherin-15 exclusively during adulthood. While the absence of this isoform led to profound deafness, the lack of the other protocadherin-15 isoforms in mice did not affect their hearing.

Patients who carry a mutation in the gene encoding protocadherin15 are affected by a rare devastating disorder, Usher syndrome, which is characterized by profound deafness, balance problems and gradual visual loss due to retinitis pigmentosa. In a separate approach, the scientists also sequenced the genes of 60 patients who had profound deafness without balance and visual impairment. Three of these patients were shown to have mutations specifically affecting protocadherin-15 CD2. "The demo-nstration of a requirement for protocadherin-15 CD2 for hearing not only in mice but also in humans constitutes a major step in the objective of deciphering the components of the auditory mechanotransduction machinery. This isoform can be used as a starting point to identify the other components of the auditory machinery. By focusing our attention on the CD2 isoform of protocadherin-15, we can now consider developing gene therapy strategies for deafness caused by defects in this gene," says EMBO Member Christine Petit.

http://www.sciencedaily.com/releases/2014/06/140617093714.htm

Canadian Hearing Report 2014;9(5):4.

TEXAS A&M, STANFORD RESEARCHERS ADVANCE UNDERSTANDING OF HOW HEARING WORKS

Source Newsroom: Texas A&M University

Understanding how hearing works has long been hampered by challenges associated with seeing inside the inner ear, but technology being developed by a team of researchers that includes a biomedical engineer from Texas A&M University is generating some of the most detailed images of the inner ear to date. The research is offering new insight into the mechanics of hearing that could lead to new therapies for hearing loss.

http://www.newswise.com/articles/texas-a-m-stanford-researchers-advance-understanding-of-how-hearing-works

Canadian Hearing Report 2014;9(5):4.

PEOPLE WITH TINNITUS MAY PROCESS EMOTIONS DIFFERENTLY

People with persistent ringing in their ears - a condition called tinnitus - may process emotions in the brain differently from people who do not have the condition, according to a new study.

Using fMRI scans, researchers looked at people's brain activity while the patients listened to pleasant, unpleasant and neutral sounds. The study included people with tinnitus, people who had hearing loss but not tinnitus and people with normal hearing.

Read more at:
http://www.sciencedaily.com/releases/2014/06/140625184901.htm

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Clinic Today vs. Yesterday; Is It Better?

By Ted Venema, PhD

About the Author

Ted Venema taught at Conestoga College in Kitchener, Ontario, and was the founder and director of its program for hearing instrument specialists. He has a PhD in audiology from the University of Oklahoma. Ted frequently gives presentations on hearing, hearing loss and hearing aids and is author of the textbook Compression for Clinicians, published by Cengage and now in its second edition.

COMPRESSION FROM YESTERDAY TO TODAY

My career in this field began in the late 1980s, 1987 to be exact. I was a new audiologist in Toronto, working at The Canadian Hearing Society on 271 Spadina Rd. Almost all hearing aids were analog and provided linear gain, although a few compression circuits did exist. These used a rudimentary form of *output limiting* compression, with its obligatory high knee-point and high compression ratio. One could raise or lower the knee-point which correspondingly, raised or lowered the maximum power output (MPO). The same compression hearing aids also almost exclusively used *output compression*, meaning that the volume control changed the gain, but not the MPO. A few *input compression* specimens from Siemens tended to float around, where the volume control adjusted both the gain and the MPO together. I recall one of these even used something called ASP (automatic signal processing). Most of us hadn't really figured out what that was, but basically it turned out to be a precursor of BILL (bass increase at low levels). BILL as we all know (right?) was actually a type of frequency dependent compression that emerged a few years later...

Wide dynamic range compression (WDRC) entered the scene with a mighty splash right around 1990. Research on cochlear hair cells had become distilled into the clinical arena. The action of the outer hair cells (OHCs) was now understood by clinicians as being distinct from that of the inner hair cells (IHCs). As we all know today, the OHCs enable the IHCs to sense soft incoming sounds below around 50 dB SPL. As a newcomer to compression, WDRC was seen as a rather "intellectual" type of compression, in that it sought to imitate the role of the OHCs. With its low knee-point and a low compression ratio, the focus of WDRC is to elevate the "floor" of hearing sensitivity, rather than on limit the MPO or "ceiling" of loudness tolerance. ReSound was a big proponent of this type of compression, with its focus on "restoring normal loudness growth." I was in the PhD program at the University of Oklahoma, and I distinctly recall one of my profs saying how happy he was that finally some intellectual research was being "heard" by a manufacturer. Of course, it is no coincidence that oto-acoustic emissions (OAEs) – also known to arise from the action of the OHCs - suddenly emerged as part of clinical practice.

By the mid 90s, I had moved to Canada and now worked at Unitron, Canada's only home-grown hearing aid manufacturer. The "gospel" of WDRC had not yet reached the ears of all those in clinical practice…I remember fielding customer service calls with upset clinicians wondering why their adjustments of WDRC weren't raising or lowering the MPO. We had to tell them, "No, when you change the knee-point in WDRC, you are actually adjusting the amount of gain provided for soft input sounds!"

WDRC itself soon split into two camps, BILL and TILL. Oticon was a big promoter of BILL, which is basically WDRC confined to the lower frequencies. Mead Killion then offered his KAMPTM circuit, which used TILL (treble increase at low levels). This was basically WDRC confined to the higher frequencies. Are we having fun yet?

Hey, this was about as bad as it got!

Honestly. Compression in today's digital hearing aids hasn't really changed all that much from that used in those now-vintage hearing aids. We continue to use both output limiting compression and WDRC. The point I really want to make here is that 1990s was the "golden age" of compression, and here is why: the analog hearing aids of that time used either one type of compression or another. *Clinicians had to know their compression types, because their hearing selection for any client depended on this knowledge*. Manufacturer fitting software did not yet exist. On the other hand, today's digital hearing aids are programmed by software. Once the audiogram is entered through Noah, the hearing aid signal processing is automatically programmed to provide output or input compression, output limiting compression or WDRC, whatever. We've become "dumbed down," because we no longer have to know how to apply the compression. The manufacturer fitting software takes care of all of that!

TODAY'S FITTING MADNESS

With the advent of digital hearing aids in 1997, the madness of fitting software began to emerge. On a semi-annual basis, the bells and whistles chimed and screamed as they grew in number. With goals and deadlines of their product management cycles, manufacturers are pounding out digital hearing aids in spades. The cacophony of their escalating product releases has become deafening. What's more, they come with all kinds of dongles, Bluetooth, remotes, and gadgets.

Digital technology and software certainly do add flexibility; *they also however, invite their best friend, complexity.* There are so many parameters involved with fitting now. Let's look at a few: noise reduction amounts and types, directional microphones and associated polar plots, feedback suppression adjustments, linking binaural hearing aids, and don't forget about the battery indicator beeps! There's more. Yes, we now must make *combinations* of the above-said parameters, in order to specifically address various different listening situations, such as quiet, conversations, and traffic.

HAS ANYONE SEEN ANSI? WHERE'D IT GO?

Sometime during the late 1990s, with the advent of digital hearing aids in 1997, ANSI slipped away. It happened in the middle of the night. Since the 1950s for hearing aids, ANSI was intended to be a measurement standard for hearing aid *hardware*, which consists of the microphone, amplifier, and receiver (aka speaker). Add in a few capacitors, resistors, inductors (and trimmers to adjust their behaviours), and you still have nothing but analog hardware. Such is the consistency of analog hearing aids. ANSI ruled in the analog land of hardware. Fitting software now rules; quaint concerns about stuff like OSPL90, Reference Test gain, Harmonic Distortion, and Equivalent Input Noise have almost faded from our collective clinical memory. Today it's all about software. Most clinicians today never bother with ANSI because they are just trying to figure out the fitting software. No, I'm not trying to be a Luddite, just stating the facts.

THE CORDS, THE CORDS, THE CORDS…

The emergence of the cords actually began in the very late 1980s, with the first "programmable" analog hearing aids. For these hearing aids, a cord from a computer (or more often a hand held programming device) could be plugged into a socket on the faceplate of an ITE or on backside of a BTE. Adjustments could be made via this "digital screwdriver," thus eliminating the need for individual trimmers being turned by a screwdriver.

Most hearing aid adjustment in days of yore (less than 20 years ago), however, was done by trimmers, trim pots, potentiometers, whatever they were called (Figure 1). Clinicians simply turned these clockwise or counter-clockwise, in order to raise or lower the MPO, gain, low-cut, high-cut, etc. Talk about simple. No cords, no Bluetooth, no dongles, no muss, no fuss. I used to laugh that if the original settings were somehow lost, one could simply set all the trimmers half way; that way, one could maximally be only half wrong. All kidding aside, Real Ear Measures (REM) were around back then, and the better clinicians among us used it too, make no mistake about that.

In 2001 I left Unitron for teaching full time at Western (aka U of Western Ontario), in London, and later on at Conestoga College in Kitchener. The days of digital hearing aids and fitting software were upon us by then. Still, whenever I demonstrated hearing aids in classes, I always had to go for my vintage green Unitron case with its store of analog BTEs. The reason why, is because I could demonstrate the effects of adjustments so easily, just by turning the screwdriver. Student simply listened while turning the screws. If I wanted to do the same with today's digital hearing aids, I'd have to turn on the computer, make sure the HIPRO or NoahLink is ready, and *most importantly, be absolutely sure I have the right cords to plug into the hearing aids!* The cord issue is not at all new, as I am not the first to complain about that. It is truly amazing just how

Figure 1. These are two Unitron BTEs of yesteryear. On the left is the UE12, and on the right is the "mini" UM60. Aside from its large size and obligatory volume control, note the trimmers at the centre of each, which could be turned with a small screwdriver. These were "potentiometers;" turning them makes them work much like a dimmer switch for a dining room light. The left has 3 trimmers, for MPO (top), Gain (centre), and Tone (bone controls like these functioned much)

many different cords exist for the product line up of any one manufacturer.

Last year, I ran an office with NexGen Hearing in Victoria BC. I always felt a little embarrassed when I had to grab two cords, one for each ear, from a rack I had made on the wall. I'd then connect them to this weird looking hook that I'd hang around the client's neck. I'd then sit in front of my computer, hoping and praying the software would read the hearing aids. It often didn't, but not because the manufacturer did anything wrong. No, it was usually because I was just trying to figure it all out. The manufacturers got to know me very well, but no longer as a teacher who'd bring his students in to visit their facilities. No, now they were helping out this customer who just couldn't seem to figure it all out. Clients were often amazingly patient with me. Some would say, "You're not very good at this, are you?" Then they'd say, "I really like the way you explain things though, you really should have been a teacher!" I'd put my head in my hands and reply, "I used to be one!" Honestly though, those dangling cords always gave me the creeps.

EXPLAINING TECHNOLOGY TO THE ELDERLY

It is one thing to program what I believe to be overly complex hearing aids along with their Bluetooth remotes and gadgets; it's quite another thing to then try to get elderly people to make sense of it all! Clinicians today are constantly "putting out fires," and I think they are doing so far more today that they ever used to do in the past. Clients would come into my office with small bags containing unused cords, boxes, and television streaming devices and dongles. I truly believe that in marketing to the elderly, the manufacturers have gone "out to lunch." Murphy's law rules: if something can go wrong, it will. The more complex something becomes, the more easily something goes wrong. As a clinician, I was endlessly repeating and demonstrating how to pair Bluetooth devices to television sets and telephones. In an effort to be extra helpful, I'd actually find myself at clients' homes crawling behind dusty television sets, and calling from other rooms to demonstrate telephone usage. On my way home I'd think, "I used to be a prof, now I feel like Ted the cable guy." It's just not audiology anymore; at least not the way I understand it.

People and hearing aids have mixed like oil and water since Lybarger's day more than a half a century ago. It's true that hearing aids are far better now than they were. The disappointing thing though, is that the *rate of client satisfaction has not risen at the same rate as hearing aid development and complexity,* and I think the key word here is "complexity." The unwanted by-product from complexity is confusion, and it is felt by both clinicians and clients.

We have made amazing strides in technology, digital algorithms and features (although manufacturers continue to give similar features completely different names). The downside is that it has all come at a cost, literally and figuratively, to clients and clinicians. With all the recent "progress," I'm not sure clinicians feel that fittings are easier today than they used to be. I also do not believe the monetary cost of hearing aids compared to eyeglasses is at all well understood by clients.

If we could return to more direct simplicity, I think both clients and clinicians would both be a lot happier. There was a philosopher some 700 years ago named William of Occam, who came up with a maxim called "Occam's Razor." It says, "The simplest explanation is the best one." In the world of hearing loss and hearing aids, clients and clinicians, might it just be possible to take this one step further? Maybe the simplest explanation is the *correct* one!

Canadian Hearing Report 2014;9(5):6-8.

Ted Venema taught at Conestoga College in Kitchener, Ontario, and was the founder and director of its program for Hearing Instrument Specialists. He has a PhD in audiology from the University of Oklahoma. Ted frequently gives presentations on hearing, hearing loss and hearing aids and is author of the textbook Compression for Clinicians, published by Cengage and now in its second edition.

WHEN FITTING HIGH-TECH HEARING AIDS, DON'T PROMISE THE MOON

By Bob Martin

Today's advanced hearing aids offer lots of features that consumers may find pretty amazing. As a result, hearing care providers may be tempted to parade these high-tech wonders in front of their patients to get them excited about what they offer. In my opinion, this is a huge mistake!

If you promise too much, the patient will expect too much, and you will end up spending too much time and energy dealing with unhappy, disappointed patients.

The fact is, most people purchase hearing aids for simple, basic reasons: They have difficulty hearing their family; they want to hear better at religious services; they need to hear better at work.

If you put too much emphasis on things like "frequency transposition" and "automatic environmental adaption" and on trying to persuade patients that these state-of-the-art features make a pair of hearing aids worth $6000, you are setting yourself up for a fall.

Today's hearing aids do have some remarkable capabilities. They enable you to hear on your cell phone using a Bluetooth connection. A hearing aid's directional-microphone system tracks the location of sound, which allows you to converse with a person sitting behind you in the back seat of your car.

These features are wonderful, and some consumers go crazy over them. But to most patients who come into your office, they are the icing on the cake—not the cake.

ONE BASE AT A TIME

I tell my hearing aid patients that the process we are going to follow is like scoring a run in baseball: We have to get to "first base" first, then to "second base" and "third." We can't expect to hit a home run on the first pitch.

I don't want to overload and overwhelm the patient with a long list of "do thises and do thats." My goal is to give them excellent hearing…slowly…emphasis on the word "slowly." Solve the most basic problem the first week. Then, solve another problem, deal with a different situation, the second week.

Eventually you will implement all the features of the system and maximize its potential benefits. But, doing this takes time, patience, and a good deal of work. So, to reduce frustration to a minimum, limit the patient's expectations to "do-able" levels.

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Canadian Hearing Report 2014;9(5):9.

Selling Your Business?

By Adam Perrie

In the not too distant past there was little to no *corporate* interest in hearing testing and dispensing of hearing aids. The fitting of hearing aids was left in the caring, capable and personalized hands of *individual* practitioners who really had a passion for serving their patients and enjoyed the art of fitting their own unique needs and requirements with the best possible products that were available. Discussions over valuation or worth of an existing practice might revolve around how much money per file, goodwill, plus depreciated value of the audiometric testing and hearing aid measurement equipment.

This has dramatically changed in the past 10 years as investors and other groups have made hearing aids into a serious viable investment interest. To add to this situation, some manufacturers have aggressively sought to secure their profit through secured lines of distribution.

THINGS TO THINK ABOUT FIRST…

If your business is declining, the competition is too fierce, or you just have had enough of being the chief cook and bottle washer then selling your practice may be a viable option for you. There are many reasons that you might want to sell your business. It is not a decision to be rushed or made lightly. Retirement, a desire to belong to a larger group, local competition or family member succession are but a few

motivations to sell your business. The exit strategy or impending retirement is a pretty solid reason. You have put your blood sweat and tears into your practice and now perhaps due to health or age you would like to get out of the business and enjoy a quieter or different pace of life.

You need to determine for yourself well in advance when you wish to retire and how. If you would like to sell your practice and remain on as part-time staff for 5 years, then you should stipulate this up front. Keep in mind that working for someone and following their practices in "your" clinic can be difficult, painful and perhaps impossible. A 3–5 year contract can be a long haul and be immensely stressful for both you and your former staff. An alternate strategy to selling your business to a corporation would be to take on an associate. This would be ideal in cases where you want to maintain the practice as it is and as it operates. As the years go by you could transfer the business to the associate and take a declining role, or you could become a part-time member of the office and maintain full ownership while working much less hours.

Whatever route you might pursue it is again vital to have accounting and legal assistance. A smile and handshake are not sufficient and countless examples exist of the failure of such an arrangement.

Be certain that if you want to stay on with the purchaser's organization after the sale and that you establish this before close. Items like salary, contract duration, and your roles and responsibilities *must* be predetermined in writing and in advance of close. Also remember that you can't expect to keep the salary and benefits that you enjoyed as an owner when you become an employee. (Or pending the status of your business maybe you will enjoy more?)

Make no assumptions as to your role with the future organization, or your place in their organization. Ensure that you know how the purchaser has and currently runs their operation, and what they intend to do in the future. Also, make sure that you are comfortable with all aspects of their intentions. Read and understand everything that you sign, or don't sign it. As has been proven over and over again in acquisitions, if you don't have statements in writing – you have nothing.

Just like making a major purchase decision like a car or house, you do need to shop around. Don't sign a non-disclosure or confidentiality agreement until you are committed to dealing with a given purchaser. Some non-disclosure agreements make it prohibitive for you to open negotiations with another possible buyer for 6– 12 months after discussions with the first one. There may also be a first right of refusal. This means that if you were to start discussions with Buyer A, and then stop them to start again with Buyer B, Buyer A may still have the right to meet or better the offer of any other buyer. So, do your homework well in advance of signing any paperwork.

About the Author

Adam had the good opportunity in 1991 to work in a hearing aid shell lab cleaning up on night shift. From there here worked in service and repair. Following this he worked for a great entrepreneur who taught him fitting, troubleshooting, and the satisfaction of helping people hear better every day. He has also worked in the hearing instrument specialist course at Conestoga College and currently works in the Hearing Instrument Specialist course at George Brown College.

SOME PRELIMINARY THINGS TO DO

Investigate your possible purchasers.

- How long have they been around in their current structure?
- What is their current corporate philosophy? Not just their official one, but look at how they behave as corporate citizens. Winning the employer of the year award is not a solid indicator of what kind of company you are dealing with; check and see how they treat their staff, current and former.
- How do they treat their patients? Is patient care truly #1? Is repeat business #1? Is a resale every 3 years #1? Are they able to balance all three?

Who owns the purchaser? Are they interested in establishing lines of delivery from engineering through manufacturing to end patient care, or do they have other goals? Do you agree with these goals?

Possibly the most important: Ask other people who have sold to them what they thought of the process, and what they think of the company post-purchase. Specifically find references from other people who sold their practice and then contact these people to ask how the transition went, did the company deliver on their stated promises, and would they do it again?

Make sure your company is financially presentable. You will likely require financial statements for the last three years including annual Profit and Loss, and financial statements.
Investigate your own business. Are you charging the recommended fee guide for dispensing fees? Do you enjoy the possible tax write-offs that a private business enjoys? Is your business set up as a tax shelter for your retirement (or should it be)? You don't have to be judgemental with your answers; they simply provide you with the structure to compare against what your business will be post sale. (Will you be happy with that?)

HANDING OVER THE NUMBERS

Before you make a dozen copies of your company's financials please remember who you are giving these too. If a letter of confidentiality is not in place (it should protect you, not just the purchaser), you are basically handing over some pretty vital information to some possible would be competitors. You can have your statements ready, and give out just the pertinent numbers

for discussion purposes.

What should you expect when you hand over numbers? If a confidentiality agreement is not in place you can have a discussion and ballpark numbers. Purchase price, like anything else of this importance is negotiable.

You will require an accountant and a lawyer. This is vital for the protection of you and your company. Most of us are not accountants or lawyers and you will be doing yourself immense disservice if you decide to do everything on your own. Sign nothing until the lawyer has checked it over. If you do not understand or disagree, then STOP until you do!

Don't expect an accountant to evaluate the price of your business in this climate. *It is up to you to shop around.* Expect that this step could take up to a year if you are being diligent. There are no common business models that correctly evaluate our type of business. The accountant needs to help you with tax planning on topics like retained earnings, capital gains exemptions, and other tax minimizing strategies which could save you many thousands of dollars. The last thing you want to do is to trigger massive tax payments that will seriously eat into your selling price.

HOW DO YOU WANT TO SELL THE BUSINESS?

Do you want the cheque on Friday and you will give them the keys? This can happen but is not preferred. Most purchasers want the former owners to stay on for 2–5 years post sale to help train staff and provide continuity to the patients. The purchase price will probably be spread out as payments over the course of a few years. There may be a portion withheld and paid out upon your business hitting predetermined performance targets. Be sure that you think they are attainable, they may not be renegotiated later. Alternatively, a portion may be withheld and paid out pending your continued employment.

Regarding purchase price paid out related to performance, check the purchaser's references. You may be shocked to find out how seldom this portion is ever paid out! Also, have a good look at the targets – in one example the targets for payout were over 10% growth per year. You shouldn't be selling a mature business if it is capable of 10% growth per year for the next 3 years. In many cases, negotiate what you want for the purchase price to be delivered on close; the remainder will probably be unachievable and never realized. Oh yes, also expect a significant non-compete clause. Typically such a clause will prevent you from working within a certain distance of current clinics for a given amount of years.

Also expect change, a lot of change. Back to the beginning now: Yes, you may have provided excellent service in the years that you owned your practice, but large companies bring their own systems and procedures with them. How the purchaser will operate is something that you should learn when you are investigating them. Expect that you will have to implement their methods after you have sold. You may have to change computer systems, the sign above the door, how your patients are contacted, marketing, bookkeeping, and advertising (know in advance how these expenses will be allotted or could impact your earn-out). Your roles and responsibilities may increase or decrease. Investigate thoroughly what will happen after you sell and be sure that you are comfortable with it.

In one example, the previous owner was not allowed to advertise during their 3 year earn-out and was saddled with all the labour of bookkeeping and expense of computer systems upgrades that the head company downloaded. This resulted in much more paperwork, less time spent with patients and less incoming traffic which meant that the planned earn-out was not possible or achieved.

Do seriously consider selling to an associate, colleague, or family member. If you examine the possible price that a buyer might pay on close (ignore earn-outs) and examine long-term tax strategies you could conceivably come out ahead and ensure a positive transition for both yourself, your staff and your patients.

SUGGESTED READING

www.audiologyonline.com /articles/your-own-boss-5-tips-6581

hearinghealthmatters.org/waynesworld/2013/financial-value-of-a-hearing-aid-practice (Look for part 1 and 2.)

www.audiologyonline.com/articles/buying-and-selling-audiology-practice-842

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Estimating Noise Exposure Under Headsets

By Tim Kelsall
Noise and Vibration, Hatch Energy

About the Author
Tim Kelsall is an experienced practitioner in noise assessment and control in heavy industry, including metals processing, mining, transportation, and energy. Tim is the chair of the Canadian noise standards committees. His specialties include: accoustics, noise control, noise assessment, human vibration, Canadian and International noise standards. tkelsall@hatch.ca.

More and more people are wearing headsets at work. They are found in retail stores, drive through restaurants and call centres as well as more traditional occupations like pilot and radio operator.

CSA Z107.56 is a well known Canadian Standard used to measure the noise exposure of employees under many different situations. However it does not yet provide information about measuring the noise exposure of people who are wearing headsets. A new appendix has been written to address this shortcoming. The appendix is based in part on ISO and Australian standards which use one of two methods. The microphone in real ear method involves a small microphone placed inside the headset. The Mannequin method involves measurement of the signal from the headset using a either a specially constructed mannequin or an artificial ear.

Because these measurements require equipment and expertise beyond the normal range of industrial hygienists and safety personnel, there was a worry that reliance on these measurements might severely limit the workplaces where the employee noise exposure from headsets could be measured. This would have been counter-productive. In many common cases, such as call centers, retail stores, fast food, etc. the sound level from the headset is adjusted to allow it to be heard over the existing reverberant background noise. In many such cases, there was the possibility that the exposure measurements could end up costing almost as much as it would cost to reduce the background sound level by controlling reverberation, use of barriers or headsets inside conventional muff type hearing protectors.

The calculation method proposed in the new draft Appendix of Z107.56 provides a simpler approach which can be carried out by an industrial hygienist or safety officer using the same equipment used to measure noise exposure. While recognizing the lower accuracy inherent in such an assessment, it can provide a first step in assessing and resolving these situations.

Measurements have shown that in many cases the sound level produced by a headset is adjusted by the user to be about 15 dB above the existing background noise under the headset. This simple fact provides the basis for the method. The measurement procedures are the same as used for employees without headsets. The sound level under the headset is calculated by subtracting the published headset attenuation from the sound level measured in the area using standard techniques. The sound level from the headphone signal is assumed to be 15 dB higher and the noise exposure is calculated based on the times the headphone signal is on and off during a typical workday.

For a regulated limit of 85 dBA, this would mean that the combination of the

Table 1. Example exposure calculation without headset attenuation (0 dB)

	SL, dBA	Duration, Hr
Room Ambient	70	8
NR of Headphone (set to 0 if no user fit data available)	0	
Ambient noise level under headset	70	
Headphone sound level when on (Leq)	85	
Hours headphone signal is on		1
Hours headphone signal is off		7
$L_{ex,8h}$ from ambient noise	**70**	**8**
$L_{ex,8h}$ from headphone signal	**76**	**8**
Total $L_{ex,8h}$	**77**	**8**

Table 2. Example exposure calculation with headset attenuation (20 dB)

	SL, dBA	Duration, Hr
Room Ambient	80	8
NR of Headphone (set to 0 if no user fit data available)	20	
Ambient noise level under headset	60	
Headphone sound level when on (Leq)	75	
Hours headphone signal is on		1
Hours headphone signal is off		7
$L_{ex,8h}$ from ambient noise	**60**	**8**
$L_{ex,8h}$ from headphone signal	**66**	**8**
Total $L_{ex,8h}$	**67**	**8**

background noise coming through the headset and the expected noise produced by the headset signal (itself 15 dB above the background noise inside the headset) should be no louder than 85 dBA. Most headsets provide little or no protection against external noise. Accordingly, the noise reduction of the headset is assumed to be zero unless the manufacturer can provide user fit octave band insertion loss data taken according to ANSI S12.6. The calculation must also account for the time the headset signal is on.

An example of a simple calculation without and with headset attenuation is given below in Tables 1 and 2. The calculations shown here are simplified. The actual noise reduction of the ambient by the headset would have to be calculated in either octave or 1/3 octave bands. This calculation is not shown here since it is straightforward to do and adds little to the discussion.

Note that unless the use of the headset is extremely intermittent, the Lex from the ambient inside the headset is much lower than the sound from the headset. If the headset is used more than 1 hour per day, the ambient has less than 1 dB effect on the result. In such cases the sound level under the headset can be calculated by simply adding 15 dB to the Lex,8h measured outside the headset (corrected for headset signal duration), reduced by the NR of the headset (which is zero for most headsets).

Another way to look at it is that unless the headset can be shown through subject fit data to reduce the sound level by more than 15 dB, using the headset will increase the noise exposure of the employee above the Lex,8h measured outside the headset unless the headphone signal is used very rarely. For example, a normal headphone in use all day in an ambient of 80 dBA would produce a noise exposure of 95 dBA. Reducing the headset use to 2 hours a day would still give an exposure of 90 dBA. Only if the headset gave at least a 20 dB reduction (typical of a reasonably good muff) would it start to give as little as 5 dB of protection to someone using the headset continually.

This change gives us a new capability for assessing the noise exposure of employees who could not be assessed before. It also points up the potential for headsets to be a significant source of noise exposure to those who wear them in even moderately noisy environments and the effect even a small amount of headset use can have on the protection provided even by very good muffs. Industrial hygienists are going to have to take a good look at any situation where employees use muffs for both protection and communication. In many such cases they may not be getting the protection they need.

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Canadian Hearing Report

Revue canadienne d'audition

10 YEARS

It's hard to believe, but 2015 marks the 10th anniversary of *Canadian Hearing Report*. We have a lot to celebrate!

CHR has provided hearing health professionals with the most current information on trends, technology, and the latest thinking in hearing health for the past 10 years, and we have only just begun!

New Editor

We are thrilled to announce Ted Venema has joined *CHR* as Editor-In-Chief. Ted has taught audiology at two universities (Auburn in Alabama & Western in Ontario) and HIP at two colleges in Ontario (George Brown in Toronto & Conestoga in Kitchener). Straddling both streams can lend for some stretching, but it has enabled Ted to write, edit, and lecture on what hearing professionals want to know; namely, difficult concepts presented in ways that make them easier to digest, comprehend, and understand.

New Direction

Building on Ted's idea of difficult concepts and making them easy to understand, *CHR* will continue to publish articles by leading authorities in hearing health sciences. We also welcome industry input and articles on new technologies and developments!

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We have always reached a wide audience of Canadian hearing health professionals, but now we can better refine and define our reader. Though groups like SAC, CHIPS, AHIP and our in-house request list of more than 1,000 hearing clinics, we are the only national, print hearing journal in Canada that reaches this market so effectively, in both a print format and e-based publication.

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The industry has changed over the past few years and will continue to in the future – so will *Canadian Hearing Report*. The journal will continue to evolve and support the hearing health care professionals and the hearing health care industry in this exciting and important time.

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Why the IA Limits the ABG

By Robert G. Turner, PhD

About the Author

Dr. Robert Turner is vice president of audiology and research at general hearing instruments in New Orleans. For more than twenty years he was a professor at LSU Health Sciences Center in New Orleans. He has directed clinical programs at Henry Ford Hospital in Detroit and the University of California, San Francisco. He has directed academic programs at UCSF and LSUHSC. He has publications and presentations in the areas of hearing science, clinical decision analysis, hearing aids, diagnostic audiology, and professional affairs. He has served as the first editor of the American Journal of Audiology, an associate editor of the Journal of Speech-Language-Hearing Research, and on the first editorial board of the Journal of the American Academy of Audiology. He is a fellow of the American Speech-Language-Hearing Association. He has received the DiCarlo Award from ASHA and an Outstanding Publication Award from Ear & Hearing.

In a previous publication I stated,

> *One lesser known principle is that an air-bone gap cannot be greater than the actual interaural attenuation that is determined by the type of headphone. Thus, a consequence of this principle is that the earphone determines the maximum conductive loss, that is, ABG, that can be recorded on an audiogram.1*

Why is this true? Consider the following clinical situation. A patient has a dead right ear and a normal left ear with the air conduction threshold (ACT) and bone conduction threshold (BCT) at 10 dB HL. The right ear is being tested at 1000 Hz using TDH-39 supra-aural earphones. At first, the patient does not respond to the tone. When the tone is raised to 70 dB HL, the patient responds. How is that possible since the right ear is dead? The stimulus has crossed over to the normal left ear. The earphone has vibrated the skull with sufficient amplitude to stimulate the non-test (left) cochlea by bone conduction at the equivalent of 10 dB HL, the threshold of that ear. Thus a 70 dB HL stimulus in the test ear (right) generated a stimulus of 10 dB HL in the non-test ear (left). This indicates an Interaural Attenuation (IA) of 60 dB (70 dB HL – 10 dB HL) for the THD-39 earphones. The TDH-39 earphones are replaced by ER-3A insert earphones. The testing is repeated. This time the patient does not respond at 1000 Hz until the stimulus to the right ear is 85 dB HL. This indicates an IA of 75 dB (85 dB HL – 10 dB HL) for the ER-3A insert earphones. The IA for the ER-3A insert earphones is greater than that for the TDH-39 supra-aural earphones because the ER-3A earphones are less able to vibrate the skull than the TDH-39 earphones.

As outlined above, the IA depends on the type of earphones. It can also vary with frequency and the person being tested. For TDH-39 earphones, the IA is fairly constant with frequency and has an average value of about 60 dB except at frequencies below 500Hz where the IA is slightly smaller. This is larger than the traditional minimum IA of 40 dB that is used to determine if masking is needed. This conservative value is used because of individual variations in IA. The IA of the ER-3A varies somewhat with frequency. At 1000 Hz and higher, the average IA varies from 70 dB to 85 dB. Below 1000 Hz, the average IA is larger and varies from 90 dB to 100 dB.[2]

The testing situation above is repeated with one variation. The right ear is not dead but has a conductive loss due to a complete disarticulation of the ossicles. The BCT in this ear is 10 dB HL at 1000 Hz. A 1000 Hz tone is presented to the right ear using TDH-39 earphones. The patient does not respond until the tone is presented at 70 dB HL. Which ear is responding? Masking noise is presented

to the left (non-test) ear in case the response is due to crossover. The patient continues to respond and 70 dB is recorded as the threshold in the right ear. This indicates an air-bone gap (ABG) of 60 dB (70 dB HL – 10 dB HL) at 1000 Hz.

Again, the TDH-39 earphones are replaced by the ER-3A earphones and the testing is repeated at 1000 Hz. This time the patient does not respond until the tone is presented at 85 dB HL. Masking is introduced to the left ear and the patient continues to respond and 85 dB HL is recorded at the threshold in the right ear. This indicates an ABG of 75 dB (85 dB HL – 10 dB HL) at 1000 Hz. Which threshold is correct at 1000 Hz, 70 dB HL or 85 dB HL? Possibly neither.

Consider the following. If earphones can vibrate the skull so as to generate an effective bone conduction stimulus of 10 dB HL in the non-test ear, it is likely that it will also generate a bone conduction stimulus of about 10 dB HL in the test ear. The stimulus level needed to generate this 10 dB HL stimulus in the test ear is 10 dB HL plus the IA of the earphones to the test ear cochlea. The IA for the earphones to the test ear cochlea may not be exactly the same as the IA to the non-test ear cochlea, but we would expect them to be similar. *If the disarticulation generates an air conduction loss that is greater than the IA of the earphones, the earphones will stimulate the test ear cochlea by bone conduction before the stimulus reaches a level that will overcome the air conduction loss.* Thus, the recorded ACT and the ABG are limited by the IA of the earphones and may not reflect the air conduction loss. This was illustrated by the examples above when the ACT and the ABG were different for different earphones. The ACT recorded for the TDH-39 earphones could not be correct since it increased with the ER-3A earphones, indicating it was a bone conduction response. Is the ACT obtained with the ER-3A earphones the "actual" threshold?

We can define the "actual" threshold as the free-field hearing loss that the individual experiences in the right ear in everyday life. Can we measure that hearing loss in the clinic? If the "actual" air conduction threshold is greater than the BCT + IA, the recorded ACT will approximately equal BCT + IA and not equal the "actual" threshold. If the "actual" threshold is less than BCT + IA, then the "actual" threshold will be recorded. For many years, the TDH-39 earphones were the most popular earphones for clinical use. It was thought that the maximum conductive loss (ABG) was about 60 dB HL. This was probable the due to the fact that the average IA for these earphones was about 60 dB. With insert earphones, the IA is greater and larger conductive losses can be recorded. In fact, several years ago I tested a patient with insert earphones and recorded a 75 dB ABG at 500 Hz.

In summary, when there is a significant conductive loss, the thresholds measured under earphones will be limited by the IA of the earphones and may not always represent the "actual" threshold. Use of insert earphones with a larger IA will provide a better measure of the ACT and the ABG.

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