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Fitting Methods: Islands in the Setting Sun

Roles in Successful Hearing Aid Fitting: Consumers, Audiologists, and Manufacturers

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Welcome to Issue 2 for 2014

This issue of *Canadian Hearing Report* features a number of outstanding articles that focus on the relationship between the patient/customer and the practitioner.

First out of the blocks is another entry from our friends at HearingHealthMatters.org. Bob Martin's blog entry discusses the necessity to sharpen one's own communications skills in order to better help the patient/client.

Also along the same theme, Julie Purdy's article, "Roles in Successful Hearing Aid Fitting," examines what the consumer, the audiologist, and the manufacturers can do to help ensure optimal results for everyone involved.

Additionally we also bring you Julie Dimon's excellent article called "Demyistifying the Auto Phone," and Jim Kasic and colleagues update on the "Otologics Fully Implantable Hearing System."

Scott BryantManaging Editor

Canadian Hearing Report 2014;9(2):3.

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TO HELP PATIENTS COMMUNICATE BETTER, WE NEED TO SHARPEN OUR OWN COMMUNICATION SKILLS

By Bob Martin
Posted April 16, 2014

As audiologists and hearing aid specialists, we are all in the communication business. It's our job to help our patients communicate better.

It's only natural, then, that there will be times and situations in the practice of our profession that we are called upon to make an extra effort to communicate effectively with the people who come to us for help. In these cases we need to draw upon all our communication skills. Let's consider several such situations.

PATIENTS WITH PROBLEM EARS

Occasionally we see patients with truly "ugly" ears. They may be infected, there may be an abrasion in the ear, or they may be exuding foul-smelling "gunk." In cases like these, we are dealing with problems of significant magnitude. That makes it essential for us to establish excellent communication not only with the patient, but also with the patient's family and with their physician. We also have to make sure our records fully and accurately describe the patient's condition.

When I see a patient like this, I make sure a medical appointment is made, and I write some notes for the MD (on my practice's letterhead). I also note in the patient's chart, "Needs to see MD. Made appointment with Dr. Jones" and I make sure the family understands the problem and the need for referral. I put a re-check note on my desk and I later check to see that the patient kept the appointment.

TEACHING TELEPHONE STRATEGIES

Another type of situation that places a premium on good communication occurs when we teach patients how to use their hearing aid in specific situations, such as on the telephone. The habit of putting a telephone on your ear is almost impossible to break. Yet, many hard-of-hearing people cannot use their hearing aids if they do that. Their substantial hearing loss prevents them from hearing voices on the phone, and when you add earmolds to the ear (for a BTE fitting), you have, in effect, applied "noise plugs" to the ear. As a result, the patient has no chance at all of hearing on the phone when they place it directly on the ear.

What you need to teach patients to solve this problem is to hold the telephone near the hearing aid. In the case of a BTE instrument, have them move the telephone upward so it is actually touching the hearing instrument. Unfortunately, many patients have trouble remembering to do this, so you need to use your "enhanced" communication skills to help them establish a new habit.

I use a "Telephone card" that I give to all patients who need it. It says: Turn the telephone switch to "T." Increase the volume (if needed). Hold the telephone against the hearing aid, not the ear." When I do rechecks, I ask patients how they are hearing. If they are having difficulties with the telephone, I practice with them and give them another card.

SPECIAL ATTENTION FOR WAXY EARS

A few patients have excessive amounts of wax in their ear canals. They need special attention because the wax will significantly increase the incidence of hearing aid malfunctions unless we get it out.

Schedule patients like these for checkups every three months, and keep track of the people on this list. If their ears are kept clear, the number of repairs drops markedly. These people need reminder notes and reminder phone calls to make sure they keep appointments.

LEARN THE REPAIR SHOP LINGO

Here's one last idea to improve your ability to communicate. We all have a list of people at the hearing aid and earmold companies that we contact when we need help.

Ask your favorite contacts to tell you what words to put on repair orders, etc. If you keep experiencing the same problem, e.g., the aid goes dead, you may be dealing with a different problem than you thought. Manufacturers speak their own language, so it helps you to learn the "buzz words" that factory repair departments use.

http://hearinghealthmatters.org/hearinprivatepractice/

Canadian Hearing Report 2014;9(2):6-8.

20Q: 25 Years of MarkeTrak - The Highlights

Sergei Kochkin, Ph.D., Better Hearing Institute
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FROM THE DESK OF GUS MUELLER

Remember the spring of 1990? You were probably talking about the movie that had just been released starring Richard Gere and Julia Roberts. And maybe listening to some good Tom Petty music from the 1989 CD, Full Moon Fever. If you happened to travel through Colorado about that time, you no doubt heard about this guy named Jeff Lebesch, who was brewing a unique Belgium beer in his basement called "Fat Tire." And, if you were reading about audiology at that time, you may have picked up the May 1990 issue of The Hearing Journal, and noticed an article entitled, "Introducing MarkeTrak: A consumer tracking survey of the hearing instrument market." The actual data collection process for this 1990 report started a couple years earlier, which means that MarkeTrak is now turning 25. And over those years, we've had eight, make that VIII, large scale MarkeTrak reports

It was in the early 1980s that the Hearing Industry Associates (HIA) began looking into consumers' satisfaction with and attitudes about hearing aids. In 1984 the HIA published a lengthy report based on a survey of hearing aid owners and hearing-impaired non-owners, which set the tone for many of the MarkeTrak surveys to follow. I recall a couple findings from that early report that caught my eye: Most hearing-impaired non-owners went to their family doctor for help, and the majority (55%) was told that their hearing loss "wasn't severe enough" to warrant the use of hearing aids. Another striking finding was that about 14% of the people who owned hearing aids never used them. Funny thing—those data are not much different than what is happening today

Through the years, the MarkeTrak surveys have become the "go-to reference" for most anything we'd like to know about the hearing aid market, the opinions of hearing aid owners or hearing-impaired non-owners. It would take pages just to list the titles of all the different issues and topics that have been reported in the 35-40 publications surrounding these studies. While the initial surveys were funded by Knowles Electronics, Inc. and the more recent ones conducted under the direction of the Better Hearing Institute, there is one person whose name has become synonymous with MarkeTrak—Dr. Sergei Kochkin. It only seems reasonable to have him stop by 20Q to provide us the highlights from these 25 years of data collection.

Sergei Kochkin, PhD, is Executive Director of the Better Hearing Institute in Washington DC. Previously he was Director of Market Development & Market Research at Knowles Electronics and served as chairman of the Market Development Committee of HIA. His background is in industrial psychology and marketing, although he has more publications in audiology trade journals than most audiologists—including clinical topics such as best practice for hearing aid verification and validation. He also is recognized worldwide for his presentations and workshops, and the data he has provided over the years has been studied and absorbed by entrepreneurs, hearing aid manufacturers, audiologists, hearing instrument specialists and consumers. While Sergei's extensive library of publications from MarkeTrak data are known to be heavily laden with charts and tables, it's rather ironic that his most read publication about hearing aids does not include even one chart or table. In case you're one of the few who have missed this article, it's titled: Hearing Aids - An Unexpected Way to Improve Your Sex Life

Dr. Kochkin's undergraduate training was in anthropology, as his career goal at that time was to be an archeologist. We are thankful that in later years he re-focused his digging toward the MarkeTrak data, to help us better understand what consumers are feeling and thinking, and what we can do to make things better. Sergei joins us at 20Q to discuss some of the treasurers that were unearthed from his many years of excavations.

Gus Mueller, Ph.D.
Contributing Editor
June 2012

To browse the complete collection of 20Q with Gus Mueller articles, please visit www.audiologyonline.com/20Q

20Q: 25 YEARS OF MARKETRAK - THE HIGHLIGHTS

1. You're that guy that keeps doing surveys, right?

I guess you can call me the "survey guy with a purpose" although some people mistakenly think I am a just a statistician who has an illicit love affair with numbers! Actually, I am a marketing oriented psychologist. Through my role at the Better Hearing Institute (BHI), I use my expertise in quantitative analysis to engage the hearing health industry in a dialogue on core issues concerning hearing healthcare. Our explicit goal at BHI is to improve hearing healthcare and ultimately to help more people with their hearing loss. When I came into this industry from United Airlines in 1988 to work for Knowles Electronics, the goal was for me to find ways of expanding the market for hearing aids and therefore their [Knowles] components. The perplexing question was and still continues to be, why is the adoption rate for hearing aids so stubbornly low and what can be done to expand the market? I heard lots of opinions when I first entered the industry. And when I hear opinions, some which don't make intuitive sense, it motivates me to find the facts.

2. So to find the facts, you started doing surveys?

Actually, the first thing I did was to look at the 1984 Hearing Industries Association survey; this in my opinion was really the first MarkeTrak and I continue to use the methodology started in that ground-breaking research. In addition I read every market development article and dissertation on the subject that I could get my hands on. In MarkeTrak I and II, which were conducted around 1989, we used only a short screening survey and at first intended to simply administer this every six months to discern trends over time. We learned after these first 2 rounds that the market did not change very fast to warrant a survey every six months and that the surveys were not in depth enough to provide very many insights into the hearing health market. So starting with MarkeTrak III we used the National Family Opinion panel to screen 80,000 households to find people with hearing loss and hearing aids. Then, we went back to people with hearing loss with a detailed survey for hearing aid owners and another one for non-adopters.

3. Where did the term "MarkeTrak" come from?

I was an MBA student in the marketing department at Knowles and we introduced it as *"A tracking survey of the hearing instrument market"*. This was a name I gave it while at Knowles to denote its market orientation. A more descriptive name might be something like, *The National Hearing Health Tracking Survey* (NHHTS), especially now that the survey is done through the Better Hearing Institute.

4. Well, we're all familiar with MarkeTrak now, so don't change it and confuse us. I believe that recently I've been seeing reports from MarkeTrak VIII? There have been *eight* big surveys?

Yes, this is the eighth MarkeTrak survey, and we just completed our 11th publication from these data. Over the years we've also administered several versions of the hearing aid owner survey to many samples of hearing aid owners, working with manufacturers to see if we could discern differences in satisfaction with various types of hearing aids. For instance, in a study of more than a dozen technologies in the early 90's it appeared that people with hearing aids that had directional technology had a much higher level of satisfaction than those without directional technology, regardless of the number of channels and memories. I think that stimulated consumer and clinical research into the benefits of directional hearing aids. At that time less than 20,000 directional hearing aids were sold worldwide and only one manufacturer routinely implemented the technology; now it is a standard feature for most BTE and ITE hearing aids across all manufacturers. The end result is a real incremental benefit in some noisy situations for some consumers, though not as dramatic as I had envisioned considering some of the work of Brian Walden and Todd Ricketts.

5. So is all this MarkeTrak VIII data just more satisfaction stuff, or is there something new?

As it evolved, every MarkeTrak survey has new components to it and some that do not change for tracking and trending purposes. But we do continue to look at satisfaction in depth, since I think it is one of the key drivers of consumer acceptance of hearing aids. An interesting thing I discovered in designing MarkeTrak is that very little had been done on customer satisfaction with hearing aids prior to 1988 with the exception of some doctoral dissertations. At United Airlines I was involved with the development of the onboard consumer satisfaction survey. This was considered a critical area of consumer intelligence since negative ratings pushed the consumer away from your product while positive ratings drew them toward your product. We also knew from the work of W. Edwards Deming, an international consultant on quality and productivity, in his landmark book *Out of the Crisis* (1982) that quality

does determine the success or failure of a product or a service. So it was rather perplexing to me that customer satisfaction was not on the radar when I first entered the hearing industry.

6. Interesting, but back to my question?

The short answer is yes, when our analysis is completed, MarkeTrak VIII will be comprised of at least 15 publications on a large variety of topics. Since the entire MarkeTrak process has been a 25 year effort, as well as dialogue with the hearing health industry, I should first tell you the scope of all the topics published across all MarkeTraks and then we can go from there:

- Prevalence of hearing impairments in the U.S.
- Demography of the U.S. population with hearing loss
- What is the real adoption rate of hearing aids?
- 20 year trends in customer satisfaction with hearing aids
- Why people delay adoption of hearing aids or what are the key obstacles to hearing aid adoption?
- How long do people really wait to get hearing aids once they learn they have a hearing loss?
- Prevalence of tinnitus and efficacy of treatments
- Impact of hearing loss and hearing loss treatment on quality of life
- The impact of the hearing health professional on real world success with hearing aids
- Pediatric hearing loss and the reasons for their low adoption rate of hearing aids
- Impact of the physician on hearing aid adoption
- The impact of hearing loss treatment on job performance
- Would lower prices grow the market for hearing aids?
- Why are so many hearing aids in the drawer?
- What would expedite demand for hearing aids?
- Is there a relationship between price and customer satisfaction with hearing aids?
- Does stigma really impact hearing aid acceptance?
- What first motivates a person to get hearing aids?
- Is there a relationship between price paid for hearing aids and customer satisfaction?
- Are bilateral loss subjects happier with one or two hearing aids?
- What improvements do people want in their hearing aids?
- What is the impact of direct mail and personal sound amplifying products on the hearing aid market?
- Do people really need a volume control on their hearing aid?

7. Wow, that is quite a list of topics. Everyone seems to be interested in hearing aid market penetration, so let's start there. What's the latest news?

Thanks. You started with one of the more complicated issues. Maybe the "latest news" is a publication from Johns Hopkins (Chien & Lin, 2011) that reports even lower hearing aid market penetration than what we have reported in MarkeTrak, which I believe is slightly less than 25%. But I have some comments on this. First, I now think that the figures that we have been using over the last 30 years are not really an accurate description of what is going on. There had been an inherent assumption that anyone with admitted or measurable hearing loss is a candidate for hearing aids. The most prevalent number out there emanating out of the 1984 study is only one in five people with hearing loss use hearing aids. Some messages are even worse stating only 1 in 5 people choose to do anything about their hearing loss *(because they don't buy hearing aids)*. Somehow by demonstrating such poor utilization, it is believed this will stimulate demand for hearing aids. If I were a person with a hearing loss I would ask one of two questions: first, "What's wrong with hearing aids since hardly anyone uses them?"; and second, "Do I want to be an outlier? You must really have to be disabled to use hearing aids." When they then look at the type of person wearing hearing aids, typically the very elderly, the potential younger candidate must enter into an existential crisis thinking that their need for hearing aids is a sign of impending death. Not surprisingly, they may go into denial.

8. You make a great point. I'd never really looked at it that way before.

I am also a slower learner, unfortunately. It was not until MarkeTrak VII (2004) that we decided that we need to look at hearing aid adoption and barriers to adoption as a function of hearing loss. All the signs as far back as MarkeTrak III (1990) stated that the number one reason people don't buy hearing aids is some variation of the reason "My hearing loss is too mild" or "I'm hearing well enough in most situations". Now the market-centric individual will say "these people simply are in denial". But intuitively I believe the consumer.

9. So how do you account for this?

I devised a method to segment people into hearing loss by developing a composite measure of hearing loss on a number of subjective self-reported measures. By extracting the common variance through factor analysis, I then divided the entire hearing loss population into deciles where 10% = the

bottom 10% of people with the lowest reported hearing loss, and 100%= the top 10% of people with the highest reported hearing loss. The clinical purists may balk at such a methodology. However, subsequent research with Dr. Ruth Bentler on 11,000 subjects using the BHI Quick Hearing Check (signs of hearing loss) demonstrated that subjective measures are correlated with objective measures of hearing loss, that such inventories of signs of hearing loss have high reliability, and that they have impressive correlations both subjectively (other self-measures) and concurrently (quality of life issues tangentially related to stated hearing loss) (Kochkin & Bentler, 2010).

10. Was this segmentation helpful for understanding the population?
Very much so—a clear pattern emerged. Market penetration is highly related to degree of hearing loss. For instance only 4% of people in decile 1 own hearing aids compared to 65% in decile 10. I think a better definition of market penetration is: 40% of people with moderate through profound hearing loss own hearing aids (deciles 5-10) compared to 9% of people with mild hearing loss (deciles 1-4); and, 65% of people with severe-profound hearing loss (deciles 9-10) own hearing aids. A further complication is how to classify the 13 million people with reported tinnitus who report they do not have hearing loss. In all likelihood they have mild hearing loss, but their tinnitus overwhelms their hearing loss. Perhaps this is why the recent Johns Hopkins study found 48 million people with hearing loss. In MarkeTrak we report 34.5 million people with admitted hearing loss; when combined with the 13 million tinnitus subjects we arrive at 47.5. If we consider that there are 8.4 million hearing aid owners, one could up with a ludicrous hearing aid adoption rate of 18%, which is clinically correct but practically wrong.

11. So what do you think is the real hearing aid adoption rate?
I think hearing aid candidacy, and therefore adoption rates, should be a function of hearing loss and recognized need. In other words, to be considered a hearing aid candidate, the individual's life must be negatively impacted in a meaningful way as a direct result of their hearing loss. I hope to improve our methodology in the future to provide a more accurate measure of hearing aid adoption rates. I venture to predict that real market penetration taking into account hearing loss and need *(it impacts the individual's life in a meaningful way)* is probably around 50%.

12. It certainly is a complex issue. What about the demography of these hearing aid users and non-adopters that you've studied?
For starters, it's important to point out that 60% of people with hearing loss are below retirement age (this is based on our survey of 2008). This should be in all of our major marketing messages as a method of combating age-related stigma. Among non-adopters the #1 cause of reported hearing loss is noise from their occupation, followed by age and then recreational noise.

A second point is that contrary to recent *(and I might add irresponsible)* media reports of an epidemic in hearing loss, the prevalence of self-reported hearing loss has been between 10-11% of the U.S. population over the last 25 years...hardly an epidemic. If it is an epidemic, certainly the people with hearing loss don't know about it or don't feel it. I tend to believe the finding of the Beaver Dam project, which demonstrated that boomers had better hearing than their parents had at the same age (Zhan et al., 2010).

13. Using your hearing loss segmentation methodology, what do you think the remaining opportunity is for increased adoption of hearing aids?
The cut-point for me when looking at hearing aid candidacy is where do more than 80% of our current hearing aid customers reside in terms of their degree of hearing loss as measured in deciles? Well, that turns out to be deciles 5-10. However, only 43% of non-adopters have hearing loss this bad, meaning the probable remaining market is 11 million people. Let us not forget though, that there are 13 million people with tinnitus and a majority of them would probably come into hearing health professional offices if we offered them hope in mitigating their tinnitus. My recent research with Dr. Richard Tyler demonstrated that indeed about 30% of people with tinnitus report moderate to substantial relief from their tinnitus by using hearing aids; this figure can climb to about 50% or more if the hearing health professional engages in best practices in fitting hearing aids.

14. If we only look at your "real candidates" for hearing aids, what are the key barriers to hearing aid adoption from the non-adopters perspective?
That's a great question, with a fairly complex answer. In a recent Hearing Review article I summarized this topic—I think you really need to break it down into four different categories: hearing aid features, hearing aid utility, psychosocial factors and financial

(Kochkin, 2012). Where do you want to start?

15. I want to hear about all, but hearing aid features sounds intriguing.
Sounds good. Understand that when I'm talking about "features," I'm mostly referring to the benefit that is obtained from these features, as that is what will drive adoption. In previous MarkeTrak studies I asked potential consumers to state why they don't use hearing aids for their hearing loss. In the most recent publication I presented the potential consumer with 53 what-if scenarios, and asked them to rate the likelihood that it would expedite their purchase of hearing aids (Kochkin, 2012). With respect to the hearing aid itself, the top issue for potential consumers is a money back guarantee (#2 among 53 issues) if they don't derive benefit.

16. What? Our patients already have a money back guarantee, at least for the first 30 days.
I know, that is a good point and deserves in depth study; I'm just reporting the data we collected. My best guess is they learned from other hearing aid owners. Consider that more than a million of our 8.4 million customers have their hearing aids in the drawer and about half of these aids are 5 years old or less. And if we look at people wearing their hearing aids less than 4 hours a day the number is quite staggering. It seems illogical that a consumer would spend so much money on a product only to put it in the drawer or seldom use it. What I'm saying is that the friends and relatives of these people who do not use their hearing aids probably *assume* that the person was never offered a "money back guarantee."

17. I really didn't realize that there were that many people not using their hearing aids. Do we know why?
That's certainly something we've studied over the years. The #1 reason for putting the hearing aid in the drawer all the way back to MarkeTrak III was *"lack of benefit"*. Now, hearing aids have come a long way since the analog days so it would be interesting to look into this in the digital age. In terms of guarantees, also rated high was a 90 day trial period. Perhaps a measurable benefit guarantee would help in assuring the reluctant consumer. In terms of a best practice protocol that would mean that all consumers would receive a pre/post measure of benefit achieved so that they know what was accomplished. And while we are on this topic, I believe we need to get rid of measures of absolute benefit and begin talking about relative benefit which would be some form of percentage change in handicap or benefit (aided versus unaided). This of course would put pressure on the hearing healthcare professional because they would have to enter into a discussion eye-ball to eye-ball with the consumer along the lines of *"Let me tell you how much better you can hear since you met me"*....not unlike the type of dialog that currently goes on with an optometrist.

18. I know you looked at benefit in general, but were there specific hearing aid features that were rated high?
Yes there were. Product features garnering high ratings were: reduction in whistling/feedback, greater comfort, better sound quality and a volume control. With respect to the latter we really need to reconsider the lack of a volume control on such sophisticated technology. With the diminishing VC we have also seen lower ratings over the last 20 years in terms of customer satisfaction. Some consumers want to adjust their hearing aids "seldom to occasionally." When they can't, I bet it makes some consumers really angry. This indirectly relates back to best practices—were the hearing aids fitted correctly—a topic that carries through a lot of these issues.

19. Benefit is probably related to listening situations. Where do these consumers really want to hear better?
While I did not present the consumer with an all-inclusive list (only representative)of listening situations, I was surprised that they value the ability to hear soft sounds most important, followed by hearing aids that work perfectly on the phone. Considering advances in technology and how much time people spend on the phone it is surprising that only 55% and 52% are "very satisfied" or "satisfied" when using their hearing aid on the telephone and cell phone respectively. The numbers are higher if you consider "somewhat satisfied"; but I would discount the latter as not being impressive to a potential consumer. People don't rave about products, services or people that make them "somewhat satisfied".

20. Well I can tell you that I certainly have been more than "somewhat satisfied" with all the information you've provided, and I can't believe my 20 Questions are up already. Can we continue this discussion on hearing aid adoption and overall satisfaction?
Most certainly—I was just getting started! If you'd like to do some background reading on all this in the meantime, all MarkeTrak survey publications are available at:
http://www.betterhearing.org

Editor's Note: Please check out the July 20Q column when our curious Question Man continues his inquiries with Dr. Kochkin regarding the highlights of 25 years of MarkeTrak. It will be found in our 20Q library at: www.audiologyonline.com/20Q

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All MarkeTrak publications can be found at: http://www.betterhearing.org

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Fitting Methods: Islands in the Setting Sun?

By Ted Venema, PhD

About the Author
Ted Venema is an audiologist and the owner of NexGen Hearing in Victoria, British Columbia.

IN THE BEGINNING WAS FUNCTIONAL GAIN

All hearing aids were Linear. Real ear measures did not exist. Sam Lybarger stood a Texas yard from the listener who wore the hearing aid, spoke in a normal conversational voice, and asked the client to say what sounded comfortably loud. He found the listener wanted gain that was close to about ½ of the hearing loss, especially for frequencies between 1000 and 4000 Hz. The "½ gain rule" was born. For lower frequencies, maybe a little less than ½ gain was recommended, so as to reduce the upward spread of masking.

Functional Gain was a behavioural measure of aided thresholds in a sound field with a hearing aid set at a comfortable volume control setting, compared to unaided thresholds measured with headphones. Aided thresholds were always measured with "warble tones," in order to reduce any possible reverberation in the sound field. I remember while holding the interrupter button down, feeling like I was playing an organ, especially with the low-frequency tones. For Functional Gain, a successful fitting would result in little letter *A*s (for aided threshold) written across the audiogram, showing a lift of thresholds about half way up toward the 0dB HL line. The idea here was that average speech inputs, plus the ½ gain, would give an output of aided speech that sat nicely within the client's dynamic range (Figure 1).

Although this goal was often stated, the outcome of aided speech output was almost never described or pictured as it would appear on an audiogram. Speaking for myself, I think this was always a missing step in terms of my own understanding of hearing aid fittings. My professors had never described it to me like that, but in hindsight, I wish they had.

Fitting methods evolved over the heady years of the 1970s and 80s from various different philosophies (Berger, POGO, Libby, NAL). Accordingly, where you'd want the little letter *A*s to sit exactly on a client's audiogram would differ slightly from method to method. I suppose these variations in letter A positions for the different Fitting Methods could be considered as different "Targets." All Fitting Methods, however, had as their spinal cord or backbone, the ½ gain rule.

THEN CAME REAL EAR

It was the mid 1980s. Hearing aids were almost all still linear. I was a new audiologist at the Canadian Hearing Society. Inside each of the four sound booths they had at that time, there was a new Real Ear device called "Rastronics CCI-10." It had a black screen and I recall all the tracings were green. Fitting Methods did not change, but Insertion Gain became the order of the day. It was faster than Functional Gain, and yielded objective, non-behavioural results. You'd simply enter the client's audiogram, choose a Fitting Method, and the objective, the aided Target, would instantly appear on the screen. The whole idea was to compare the Real Ear Unaided Response (REUR) to the Real Ear Aided Response (REAR), with the difference being Real Ear Insertion Gain (REIG). Since the hearing aids were linear, you could simply (like they say at the carnival) "pick an input…any input…" If your REIG matched the Fitting Method Target, you were good to go! See Figure 2.

Try counselling a client however, from this perspective: "Well, you see, this line is what we're supposed to hit and this little lighter line is right near it, and therefore your hearing aid is doing what it's supposed to do." The main problem here was that the *audiogram was not*

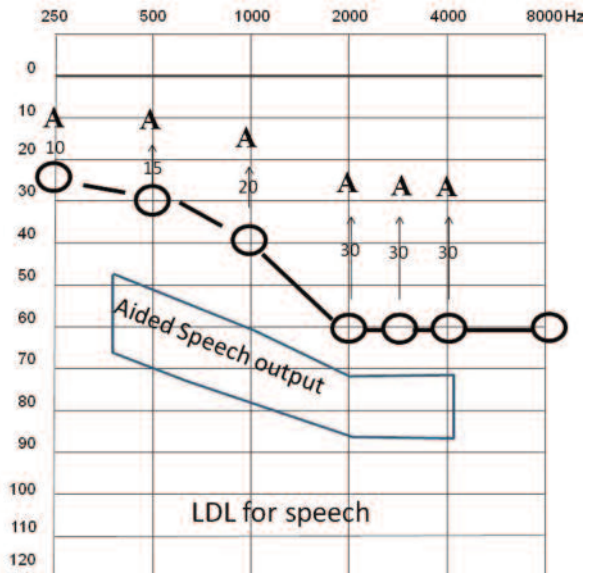


Figure 1. The A's stand for "aided thresholds." The goal was to raise the thresholds by roughly ½ (and less than ½ in the lows to reduce the upward spread of masking). This way, speech inputs, plus the ½ gain, would produce *aided speech outputs* that sat within the dynamic range and did not exceed LDLs.

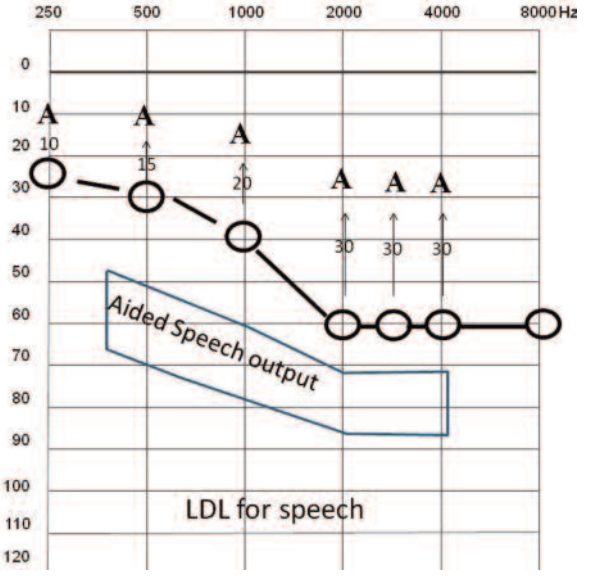


Figure 2. Note the #'s for the Real Ear targets (asterisks) here are identical to those for the As on the Figure 1 audiogram. Real Ear Insertion Gain measures however, are non-behavioural and faster. The audiogram, however, is nowhere to be seen.

visually part of the picture! Aided speech outputs had to be imagined. In this way, Insertion Gain was worse than Functional Gain. Interesting too, was that REUR wasn't incorporated at all in the unaided testing under headphones, but Oh well. Non-behavioural Real Ear measures were certainly a whole lot faster than testing someone's thresholds twice! Another good thing about good old Insertion Gain was that if someone came in saying the new hearing aid just didn't sound like the old one, you could do a quick Real Ear measure on the old one, and then make the new hearing aid do the same thing. Of course you could also do this with ANSI measures. Still, however, it's much better than relying on, "How does that sound?"

RICHARD SEEWALD REALLY IS THE FATHER OF NEWER REAL EAR MEASURES

The DSL Fitting Method arose in the early 1980s, and with it, the SPL-o-Gram. Insertion Gain and REUR were unceremoniously tossed on to the garbage heap. The whole focus was now upon In situ Output, also known as REAR. Trouble was, only Seewald and his followers used the SPL-o-Gram and DSL. Most clinicians including myself, plodded on with Insertion Gain Real Ear measures. I remember returning back to Canada in 1995 from Alabama where I taught for a couple of years. Here in this pink Commonwealth country DSL loomed large as the recommended Fitting Method. The disciples of DSL were ubiquitous and they wouldn't suffer fools gladly. I felt like an American infidel, so, as a new employee at Unitron, I attended a DSL workshop held at Western, where Seewald, Cornelisse, and Moodie diligently presented on DSL. I have to admit that I still didn't get it. Insertion Gain just seemed so easy, lots less busy, fewer lines and like an old friend, just so familiar.

I wanted, as the columnist Allan Fotheringham used to say, someone to "Elucidate the nebulosity of my phantasmagorical perceptions." It came upon a midnight clear. I remember the hour of my epiphany, "the day I first believed." It may seem blasphemous to the Cardinals of DSL, but *the* "trick" to my own understanding DSL was in tying it together with the whole unsung goal of Functional Gain; *namely, displaying where aided speech would lie within one's dynamic range*. Now, however, we actually had the tools or technology to display the audiogram, along with aided speech outputs, all on one graph, all in dB SPL, and this time, right-side up! The main trouble with Insertion Gain was picturing your purpose. Counselling with it was impossible! In 1997, NAL-NL1 emerged, and I remember how it very gradually began to follow suit with DSL's SPL-o-Gram. One could initially see their simultaneous usage of both Insertion Gain and in situ output, but this was followed within about a year by

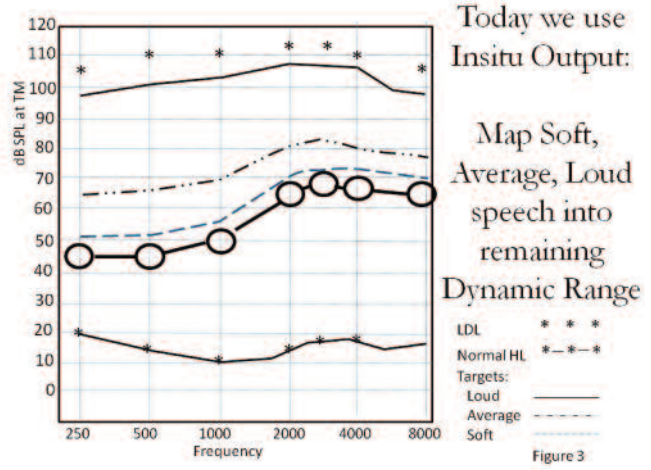


Figure 3. The SPL-o-Gram shows the audiogram, and also the targets in terms of in situ output. Note the three targets and how they are each generally placed within the client's dynamic range. All Fitting Methods seek to accomplish roughly these same objectives.

their rather quick dumping of Insertion Gain. For DSL then, imitation could be considered the finest form of flattery.

The "rub" is that all Fitting Methods were actually trying to accomplish what the SPL-o-Gram shows! *It's just that in the past, we didn't have the equipment to show it.* Up until DSL, gain was always the order of the day. Functional Gain compared aided to unaided thresholds, and Insertion Gain compared REAR to REUR. The SPL-o-Gram changed everything. Visualizing 1) normal hearing, the client's audiogram and the reduced dynamic range, and 2) unaided and aided speech outputs all on one graph may have seemed like a "small step" for a print job, but it really was a "giant leap" for audiology. Neil Armstrong taught us that we all need to look at the moon from time to time…

Check out the SPL-o-Gram (Figure 3). Everything is now in plotted according to Output, and in terms of dB SPL, so now hearing loss and hearing aids are now speaking the same language. "More" on the graph now goes up, like every other graph in the world (except the Oddiogram). Normal hearing thresholds are placed on the bottom and LDLs are placed on the top. The client's hearing loss is placed part way up on the graph, thus showing a reduced dynamic range.

Today's Real Ear is actually easier than yesterday's Real Ear with Insertion Gain. Compression hearing aids give different gains for different input levels, but they also give different outputs for different input levels. These different outputs can be displayed for soft, medium and loud inputs. Gain is now yesterday's news; it's simply a means to an end. Output is "king;" it is the "groceries that are delivered to the TM. No one cares how you got to the store; the main point is, "Did you get the bread?" The idea is to aid the listener so that the outputs for soft speech inputs sound soft, the outputs for average speech inputs sound average, and the outputs for loud speech input sound loud. Now *there's* an improvement for counselling! Clients can readily *see* what parts of speech were inaudible without hearing aids, and what has now become audible when aided. As we say in Canada, "Neat, eh?"

THERE'S ANOTHER TWIST, HOWEVER, TO THIS STORY

Fitting Methods have become so similar that if you don't compare them closely, you may not even notice the differences! Check out the target comparisons for yourselves, especially for mild-moderate SNHL. In 2005, DSL 5 for adults slid a slippery slope to nudge much closer to NAL-NL1. After that, NAL-NL2 seemed to abandon its ever-vigilant zeal to keep all aided adjacent speech frequencies equally loud. "Czech" out how the ever-present trademark of NAL Fitting Methods - the hump in the mid frequencies – is now virtually *gone* with NAL-NL2.

DSL 5 for adults and NAL-NL2 are quite similar, and have become "friends." Both place soft input speech so that when aided the output speech surrounds the thresholds. Here, you'll find that the client can barely hear it. That's normal; neither can you and I. Both place average speech inputs so that the aided outputs sit in the dynamic range about 1/3 above the thresholds. Both place loud speech inputs so that aided outputs sound loud but remain below LDLs. Isn't that what Lybarger would have wanted? Isn't that what all Fitting Methods were all trying to do in the first place? *Guess what? Perhaps with proper dynamic range considerations, we don't need Fitting Methods anymore!*

I'll confine my comments to *adults* here. For them, it looks like Fitting Methods are becoming obsolete. They originally emerged a lot like beliefs or faiths do, to which various adherents had subscribed vehemently. The SPL-o-Gram with its in situ outputs, however, provides proof for the objectives of one's faith. To borrow from Paul Simon: "Faith (Fitting Methods as a whole) is an island in the setting sun; Proof (mapping of speech into a client's dynamic range) has become the bottom line for everyone."

Canadian Hearing Report 2014;9(2):14-16

Demystifying the Auto-Phone

By Julie Dinon

About the Author
Julie Dinon is an audiologist with Bernafon Canada Ltd.

As an audiologist, one of the improvements I have seen in hearing aids over the last 23 years is the flexibility now available for both the clinician and end user. When it comes to phone use, there are choices such as telecoil, auto phone, auto telecoil. What does all this mean? With so many names for the various telephone/telecoil features found in hearing aids, coupled with the fact that different manufacturers have different names for the same or a similar feature, it is no wonder things are so confusing. So, let's review the telecoil and its many options.

Telecoils have been available in hearing aids since 1947. It is the activation of this telecoil that becomes confusing to both end users and clinicians. A telecoil is a metal rod or core with fine wire coiled around it. This coil is meant to detect electromagnetic energy and convert it to electrical energy which is then processed by the hearing aid, making it much easier to hear a signal transmitted through the telephone. Accessing the telecoil via the push button on the hearing aid is a familiar option for clinicians. What if, however, the end user is unable or unwilling to use the push button but still would like access to a telecoil program in their hearing aid.

A telecoil in itself does not activate "automatically", therefore making the term "auto-coil" somewhat misleading. The "auto" portion is actually a second coil or reed switch, separate from the telecoil that will put the hearing aid into another "program" when it detects magnetic energy. As a result, an “autophone” could lead to several different results.

In many hearing aids, the following telephone scenarios are possible:

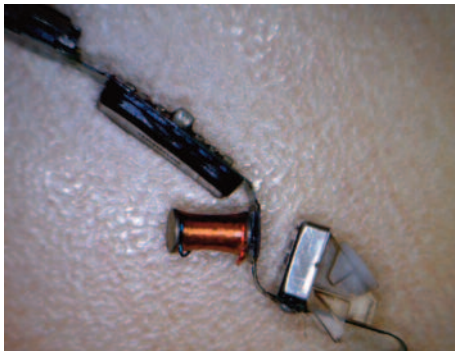
1. Push button into a telecoil program (If there is a telecoil in the hearing aid)
2. Push button into an acoustic phone program (if no telecoil in the hearing aid)
3. AutoPhone: reed switch automatically puts the hearing aid into a telecoil program if the hearing aid has a telecoil
4. AutoPhone: reed switch automatically puts the hearing aid into an autophone program if the hearing aid does not have a telecoil

In addition to putting a hearing aid into a telephone program, either through telecoil or acoustic setting, some manufacturers allow you to put the hearing aid into programs that are not related to telephone listening with activation of the auto switch.

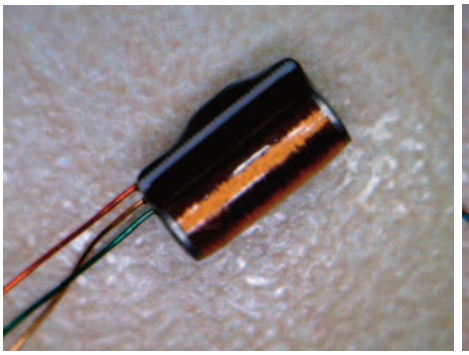
Don’t forget that reed switches may be located in different spots from hearing aid to hearing aid, especially in custom products. The end user must learn where the best spot is on their hearing aids. Also remember that different phones will give off different amounts of magnetic energy, therefore, some may require the addition of a magnet to trigger the reed switch and some may trigger with just the phone.

My best advice is to be aware of what each of the telephone related terms means for the particular hearing aid you are working with so that you can make the best choices for your end user.

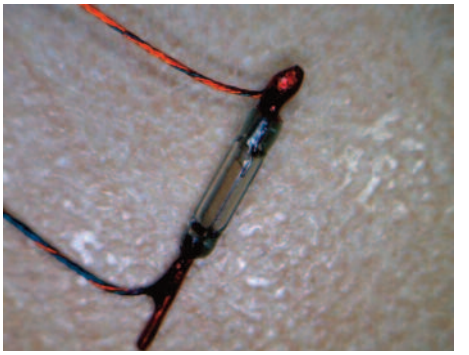
Canadian Hearing Report 2014;9(2):17



Telecoil as part of modular hearing aid circuitry.



Telecoil.



Reed switch.

Otologics Fully Implantable Hearing System

By Jim Kasic, Alan Franklin, and Robert Traynor

According to the Canadian Public Health Service,[1] 1 in 10 Canadians have some type of hearing impairment and, among those 65 years of age or older, 50% or more are affected by reduced hearing acuity. The incidence of hearing impairment notwithstanding, Canadians have much in common with their hearing impaired counterparts in other countries as the treatment for most of these losses is the use of traditional amplification devices, or hearing aids.

In the past 10 years or so, technological advances in traditional hearing instruments have substantially improved sound quality, feedback control, frequency range, noise reduction, and other areas making these products much more beneficial than ever before. In some countries, such a Switzerland, today's advanced performance traditional digital hearing aids enjoy as much as an 80% success rate.[2] While these products continue to evolve technologically and progress in user acceptance, George indicates that only 21.4% of the estimated twenty-eight million hearing impaired Americans utilize amplification regularly, a figure that holds when applied to populations across the world.[3] In an interview by Strom, Kochkin presented that of the approximately 6 million hearing instrument users, 35–50% are not satisfied with the benefit obtained from their instruments.[4] The typical concerns of hearing impaired patients leading to reduced use of amplification vary, but poor sound quality, feedback, limited frequency range, occlusion, pain or irritation, moisture, social stigma, and cosmetic issues are frequently cited as major concerns. Recognizing that stigma and sound quality would always be issues to those that use traditional hearing instruments, audiologic and otologic research has been on a quest to find an efficient, practical method of middle ear implantation that would counter-act many of the concerns and difficulties of hearing aid use.

DEVELOPMENT OF THE OTOLOGICS MET TRANSDUCER

Although some otologic researchers felt that electromagnetic or peizoelectric techniques would offer an effective and efficient middle ear implant; Dr. John Frederickson, a 1970s research otolaryngologist at Washington University, St Louis, Missouri, expressed concern that these crude technologies lacked the bandwidth and acoustic output to be practical applications. With funding from Washington University and Storz Instruments, Frederickson and colleagues developed and refined the electromechanical motorized transducer (Figure 1) and continued experiments with various transducer placement sites within the middle ear. While evaluating placement of an electromechanical, motorized transducer (now called the Middle Ear Transducer [MET]) projecting into a laser drilled hole in the incus of Rhesus monkeys in 1995; Fredrickson, Coticchia, and Khosla demonstrated that there could be a safe, efficient method of transmitting sound energy to the ossicular chain. Proof of the benefit derived from the MET was demonstrated by pre/post acoustic and mechanical (bone conducted) ABRs conducted on the Rhesus monkeys implanted with the MET device. In evaluating the implanted monkeys, Fredrickson et al. found no significant pre/post changes in latency/intensity functions, suggesting that the implantation of the middle ear transducer did not cause detectable conductive or sensorineural hearing loss. Further, they also demonstrated the fidelity of the implanted device by detection of distortion product otoacoustic emissions (DPOE) generated through the implanted device.[5]

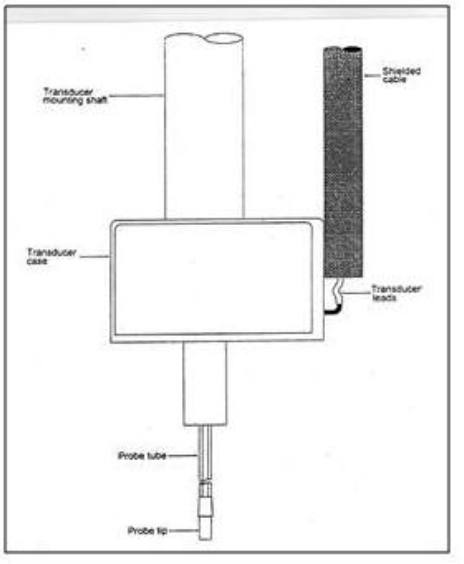


Figure 1. Early version of the Middle Ear Transducer (MET) implanted in Rhesus monkeys.[5]

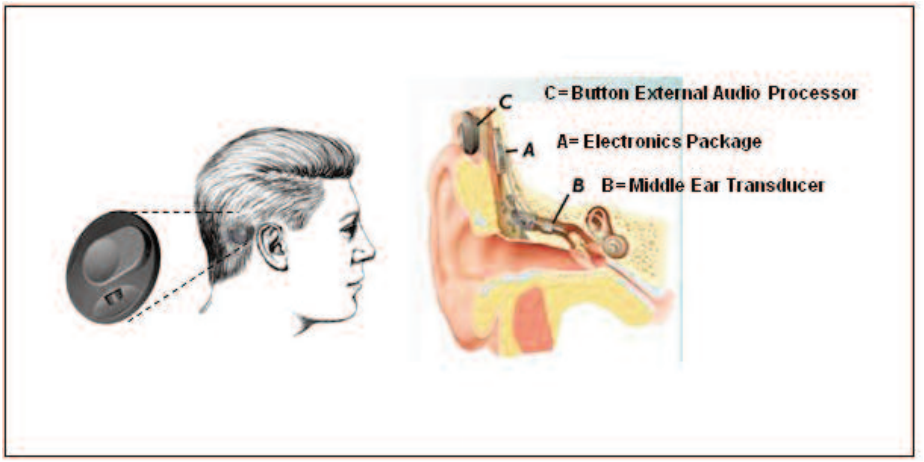


Figure 2. Otologics semi-implantable device.

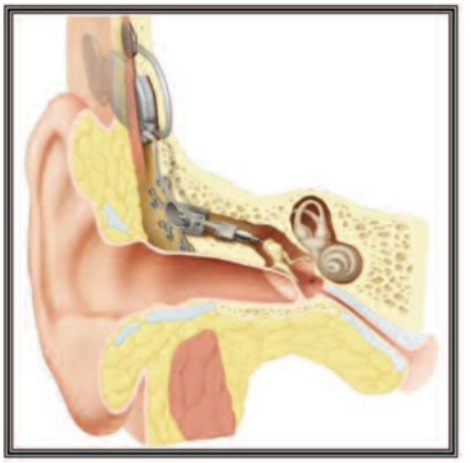


Figure 3. Otologics MET fully implantable middle ear device.

DEVELOPMENT OF THE OTOLOGICS FULLY IMPLANTABLE HEARING SYSTEM

In 1996, Washington University and Dr. John Frederickson sold the MET technology to Otologics, LLC and the company was moved to Boulder, Colorado to continue its development. By 1998, the new company had a semi-implantable product to offer for FDA investigation and the MET semi-implantable instrument was on sale in Europe by 2000. As with most early middle ear implants, the Otologics MET was first offered in clinical trial both in Europe and the United States in a semi-implantable format. Figure 2 presents the Otologics MET semi-implantable middle ear device where a button processor connects magnetically to an internal stimulator. Since the FDA clinical trial process in the United States would have significant costs, Otologics chose to not offer their semi – implantable device to the US market and concentrated totally on the research and development of the first fully implantable hearing device. The Otologics Fully Implantable MET received European CE-mark in October 2006 and is now marketed in Europe, Asia, and Latin America as the Carina Hearing Device.

After an intensive research and development process in the Boulder facility, the Carina incorporates a microphone, a speech processor, battery, and stimulating transducer into a prosthesis that can be totally placed under the skin behind the ear avoiding most fitting and cosmetic issues. The device offers the same freedom and comfort of the natural auditory system while allowing use in environments not suitable for conventional hearing aids such as showering, swimming, and sporting activities.

THE CURRENT DEVICE

The Otologics MET Fully Implantable Ossicular Stimulator consists of three primary components: the implant (Figure 4A), the remote control (Figure 4B) and the charger (Figure 4 C/D). The implant component of the MET Fully Implantable Ossicular Stimulator is

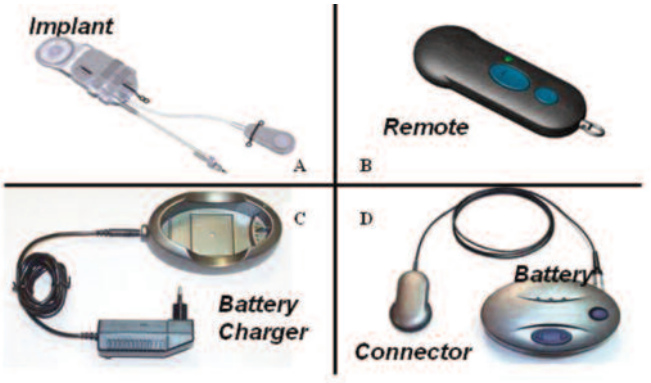


Figure 4 A–D. Components of the Otologics MET fully implantable device.

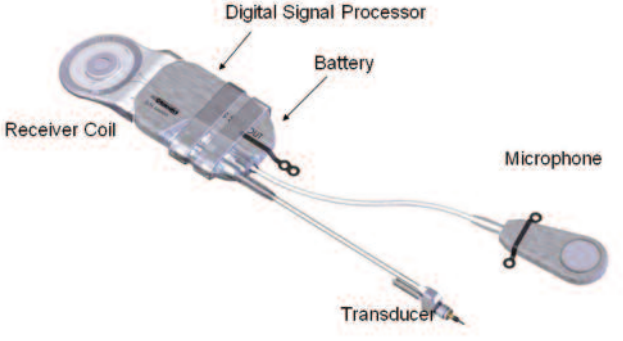


Figure 5. Magnet input/output port, battery, and signal processor, transducer, and microphone.

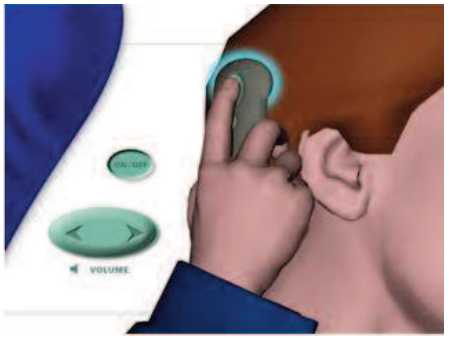


Figure 6. Otologics remote control.

Figure 7. Otologics ccharging system.

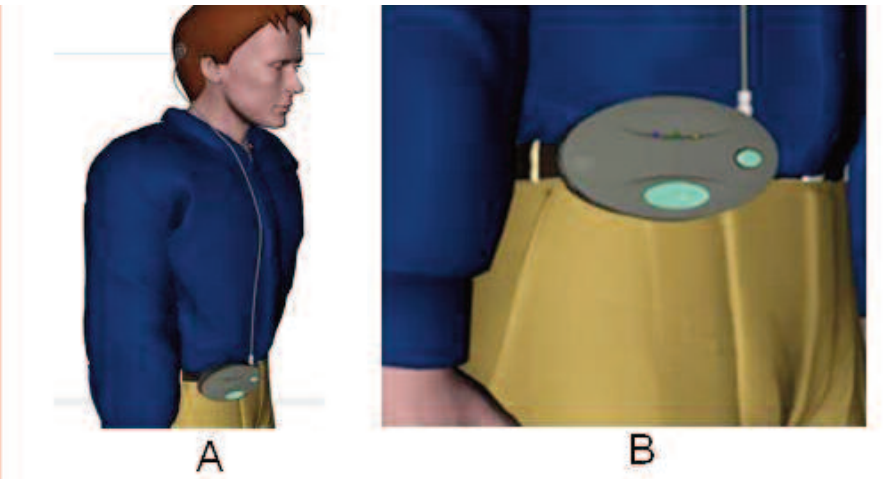


Figure 8. Otologics belt-worn charger.

Figure 9. The Otologics programming system.

shown in detail in Figure 5. The implant consists of a signal processing electronics capsule, a pendant microphone system, the internal battery, and an electromechanical transducer. Specifically, the electronics package comprises two digital signal processors, control circuitry, battery, radio frequency coil, and a magnet.

The current MET transducer is a highly modified version of the original transducer first investigated by Fredrickson et al.[5] Basically, the operation of the Otologics MET fully implantable device is rather simple in that sound is picked up through the skin by an extra sensitive pendant microphone. This is converted into an electrical signal, digitally processed according to the patient's hearing requirements, and conducted down a lead and into the transducer that is mounted in a laser-drilled hole in the body of the incus. The transducer translates the electrical signals into a mechanical motion that directly stimulates the ossicles and enables the wearer to perceive sound.

A remote control (Figure 6) allows the wearer to turn the implant on and off, and to adjust the volume. To use the remote control, the wearer simply holds the remote against the skin over the implant magnet.

The charger system is the power supply for the hearing device and consists of the base station, charging coil, and charger body (Figure 7). Usually the battery charger is plugged into an outlet and the battery fits inside the charger and, once charged, the battery may be used to charge the implant. The charging coil is placed over the magnetic attachment at the implant site and the charging time is typically one hour if the process is performed daily. The battery also has a clip (Figure 8) that allows the charger to be attached to the belt or waistband of the wearer during the charging process. While charging, the user can hear with the implant as well as turn it on and off, and adjust the volume.

THE OTOLOGICS PROGRAMMING SYSTEM

The programming system consists of

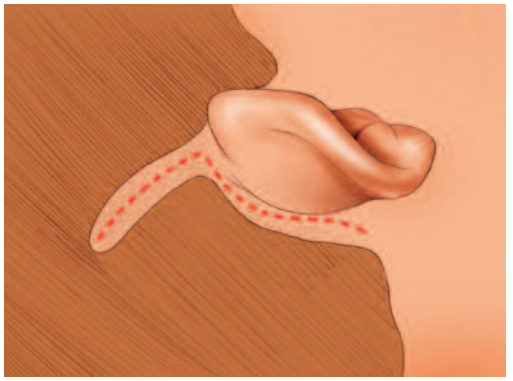


Figure 10. Surgical incision for Otologics Fully Implantable MET.

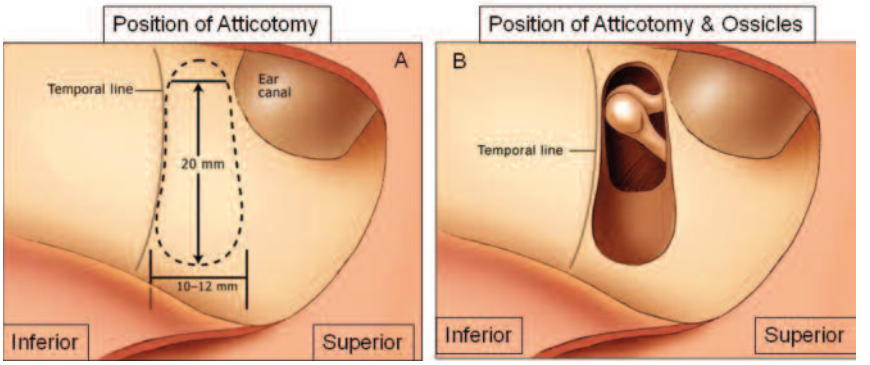


Figure 11. Position of the atticotomy. .

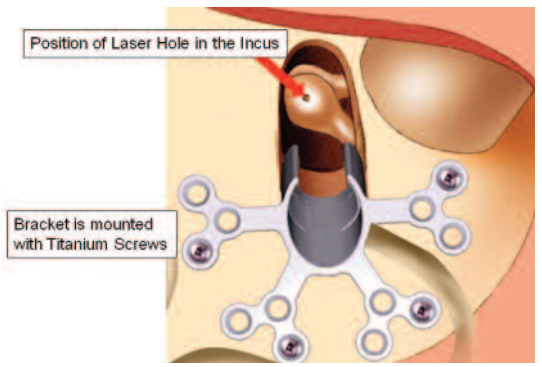


Figure 12. Laser hole and laser guide/transducer mounting bracket.

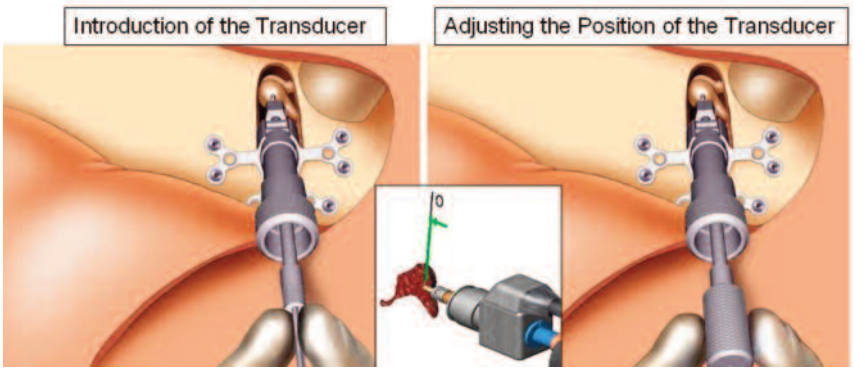


Figure 13. Placement of the transducer.

fitting and diagnostic software, a radio frequency coil that, when placed over the implant site, magnetically adheres to the side of the wearer's head, and the NOAHlink™ programming interface, which is worn around the neck (Figure 9). Using OtoFit™ Fitting Software, the NOAHlink interface receives signals from the computer through the wireless connection and sends the signals to the implant via the radio frequency coil. Programming the implant is done in the same manner as programming traditional digital hearing aids. In addition, the Otologics Programming System provides the ability for extensive testing and diagnostics of the MET Fully-Implantable Ossicular Stimulator.

SURGICAL OVERVIEW: SENSORI-NEURAL IMPLANTATION

The implant surgery is a relatively simple 2-hour procedure and not difficult in practiced hands. The incision is presented in Figure 10 and is similar to that for cochlear implants or other prosthetic devices. Once the incision is made, the surgeon drills an extended atticotomy between the temporal line and the ear canal, exposing the incus body and the head of the malleus (Figure 11A/B).

A mounting bracket is secured with bone screws and a laser guide is lined up with the body of the incus for the drilling of a 0.75 mm hole with a laser.

Once the hole is drilled in the incus, the laser guide is removed and the transducer is carefully mounted with the aid of a computer and software tools that allow the surgeon to know how much to load transducer upon the ossicular chain (Figure 13). This is the delicate component of the implantation process requiring the use of a special tool called the Transducer Loading Assistant (TLA) (Figure 14). Loading of the transducer cannot dampen the movement of the ossicular chain with too much pressure, but enough pressure must be applied to create a secure transmission of the stimulus to the head of the incus. Once the transducer is loaded onto the incus, the electronics package of the implant is tested using the diagnostics software. Surgical Assistant FIMOS Implant (SAFI) that runs through the TLA. This provides real-time information to verify microphone input and internal electronics functionality, in addition to the correct loading of the transducer. Once tested, a template is used to drill a bone bed for the electronics package and the microphone. The bone bed allows

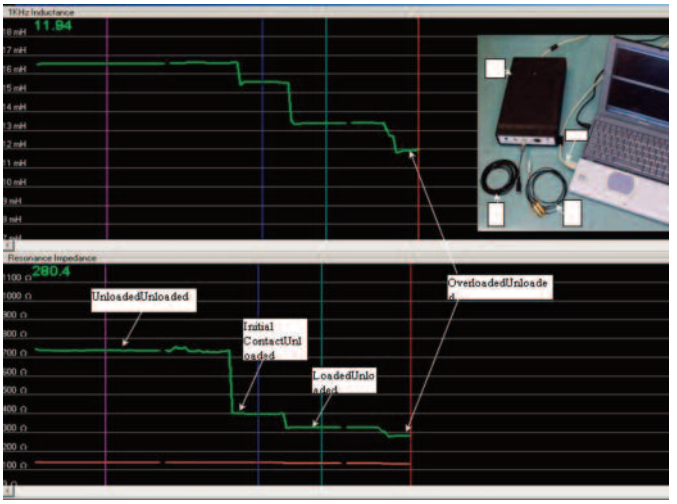


Figure 14. Transducer loading assistant.

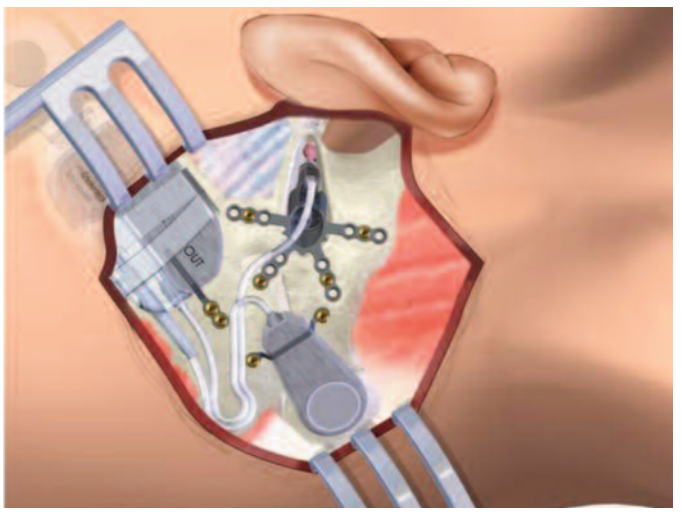


Figure 15. Drilling of the bone bed and thinning of the flap.

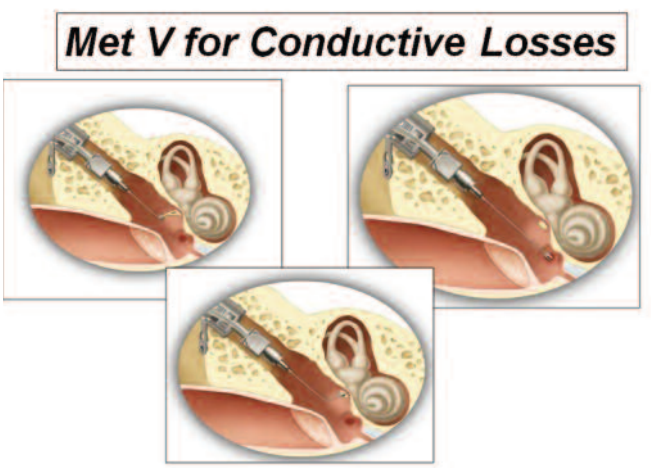


Figure 16. The Otologics Fully Implantable MET –V Conductive/Mixed Hearing Loss Application.

the electronics package to fit flush against the skull maximizing the cosmetics of the implantation process. With the electronics package placed, the surgeon then drills a bed for the microphone just posterior to the ear canal and thins the skin that will go over the microphone to 6 mm. The thinning of the flap insures the proper skin thickness to allow the extra-sensitive microphone to pick up sound through the skin. Once all of the components are in position (Figure 15), the implant and microphone are secured with titanium straps and the incision is closed with care to insure that the leads are not damaged during the process. The device is activated with the Otofit Software about 8 weeks after the surgery to allow for healing.

THE MET-V APPLICATION FOR CONDUCTIVE OR MIXED HEARING LOSS

Another application of the Otologics Fully Implantable MET device is now available for sale in Europe for conductive and mixed hearing losses. A variant of the MET, designated the MET V, has now been developed (Figure 16). In the MET V, any one of several ossicular prosthetic attachments may be affixed to the vibrating transducer element in place of the ceramic tip. This modification allows the transducer to drive an incomplete, injured or abnormal ossicular chain, as may result from middle ear disease, acoustic trauma, or congenital malformation. The attachments have been designed for effective attachment to the long process of the incus or stapes capitulum (if present), to the stapes footplate when the stapes superstructure is absent, to the round window as in cases of stapes fixation, or the oval window.

The ossicular prosthetic attachments used with the MET V are familiar to otologic surgeons and similar to prosthetics used in reconstructive surgery for decades. The incorporation of this family of attachments into the MET does not significantly change its function, but does greatly expand the options available to a surgeon treating cases of conductive and mixed loss from a broad variety of causes.

It is expected that the long-term stability of the ossicular attachment will be similar to outcomes observed for ossicular prostheses. However, one important difference from cases requiring total ossicular replacement prostheses is that an interface with the tympanic membrane is necessary. This is the single most common failure mechanism in these procedures and the MET V requires no such interface.

Placing the partial ossicular replacement prosthesis ("PORP") on the stapes at the incudo-stapedial joint requires that the

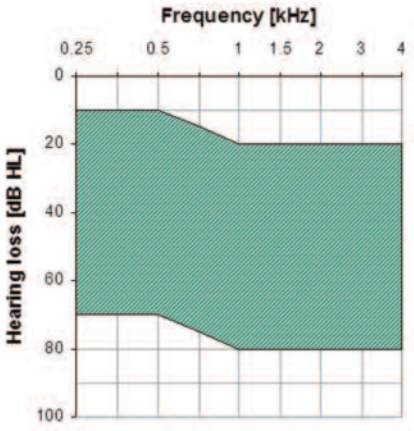


Figure 17. The Audiometric Candidacy for the Otologics Fully Implantable MET or MET-V

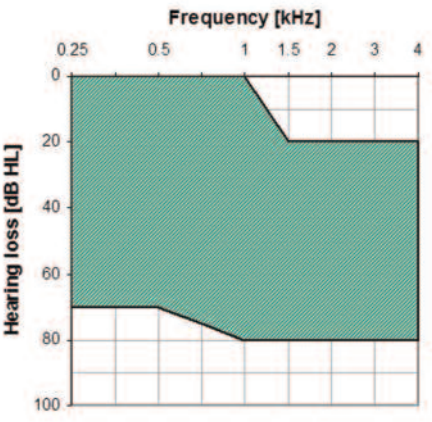


Figure 18. The Audiometric Candidacy for the Otologics Fully Implantable MET-V: Conductive or Mixed Losses.

surgeon implant the transducer through a mastoidectomy and facial recess. The facial recess is the most common surgical approach employed in cochlear implant surgery, as well as for some chronic cholesteatoma conditions. The facial recess approach is also used when implanting some middle ear implant devices.

CANDIDACY FOR THE OTOLOGICS FULLY IMPLANTABLE MET AND MET-V DEVICES

The MET Ossicular Stimulator is intended to compensate auditory deficits in adults with a moderate to severe sensorineural hearing loss. The MET V Ossicular Stimulator is intended to compensate for mild to severe conductive or mixed type hearing loss due to congenital aural atresia or ossicular abnormalities based on the bone-conduction component of the loss (Figures 17 and 18).

PERFORMANCE

World wide, more than 500 patients have been implanted with the Carina device. On average, no differences between preoperative and postoperative unaided pure tone averages occurred. Pure tone average implant aided thresholds are equivalent to that of walk-in-aided condition. Word recognition scores and hearing in noise scores were similar between the walk-in-aided and for the implant-aided condition. Patients also tend to prefer the implant compared to their hearing aid on subjective benefit scores such as APHAB.

SUMMARY

This presentation has been a discussion of the development of the Otologics Fully Implantable MET and MET-V devices. Although available throughout Europe, Asia, and Latin America; the Otologics Fully Implantable MET device is currently limited by Federal Law to investigational use in the United States. The MET V is currently not being investigated in the US, but will be in clinical trial later this year in the United States and Canada. Otologics estimates that FDA approval of the MET and MET V could come as early as the beginning of 2011. At that time the devices will be introduced to both the US and Canada.

In addition, Otologics is currently designing a smaller fully implantable electronics/battery capsule for the MET and MET V, a smaller more efficient transducer and a fully implantable module which will be able to provide power and audio signal for a fully implantable cochlear implant.

If patients are interested in obtaining information about involvement in the clinical trial for the Fully Implantable MET device in the US, they should go to www.otologics.com or call 800-390-5506 for further information.

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Roles in Successful Hearing Aid Fitting: Consumers, Audiologists, and Manufacturers

By Julie K. Purdy, PhD, CCC-A

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Approximately 10 years ago, I gave a presentation that culminated in an article designed to convince manufacturers, consumers and audiologists that we needed to take steps to improve our hearing aid fittings. At the time I bemoaned the fact that even as technology had improved with improved software and fitting tools, return rates were not appreciably lower-hovering at around 20%. In addition, market penetration was not higher despite the implementation and application of such tools. I outlined the joint responsibility that consumers, audiologists and manufacturers shared in improving the process. Ten years have passed-are we doing any better? While I suspect it is a matter open for discussion and one that is really a matter of personal opinion, I do believe we have all improved remarkably during the past few years. It is also my belief that there are areas the consumer, the manufacturer and the audiologist can continue to improve if we wish to increase patient satisfaction, lower return rates and allow the consumer to function to the best of all of our abilities.

A. RESPONSIBILITIES OF THE PATIENT/CONSUMER

Ten years ago I addressed seven areas of concern I had on the part of the consumer. They were: (1) the responsibility of the consumer to purchase a hearing aid via a clinical venue; (2) the responsibility of the consumer to be self-educated regarding hearing aids; (3) the responsibility of the consumer to pick a style of amplification that they could manipulate and were WILLING to wear; (4) the responsibility of the consumer to pick the most sophisticated form of amplification that they can afford; (5) the responsibility of the consumer to include their family members in the rehabilitation process; (6) the responsibility of the consumer to manage their own listening environment; and (7) the responsibility of the consumer to truly wish to improve their communication ability. So, has 10 years brought us any progress? I believe it has.

For many of the issues that I identified 10 years ago as areas the patient needed to improve, manufacturing has made significant improvements-enough so that we have really assisted the consumer on a few of these responsibilities. For example, Kaplan found that the primary reason hearing aids were not worn was the inability on the part of the patient to manipulate the hearing aid.[1] Manufacturers have greatly helped to reduce Kaplan's issue of manipulation. We have allowed hearing aids to be automatic in many functions from the use of algorithms to control listening environment, to automatic directional microphone switching to automatic gain reductions. For patients that wish to control their instruments, we have offered easier switching options, often with voice commands or unique tones to allow the consumer to know what changes have been made to their hearing aids. Recently, T-2 programming (shown in Figure 1) was introduced which will give the patient the ability to make changes by way of their phone. Switching to memories, changes in volume and introducing a mute are all accomplished by means of the telephone. Manufacturers have insured that patients are able to manipulate their hearing aids. If only the batteries could insert themselves, we would be in luck!

In addition to manipulation, 10 years ago patients did not always like the look of the hearing aids that they were "forced" to wear. In a study conducted with baby boomers in Canada for Starkey Labs, Antenna Research found that consumers resisted wearing their hearing aids as they were "big, brown

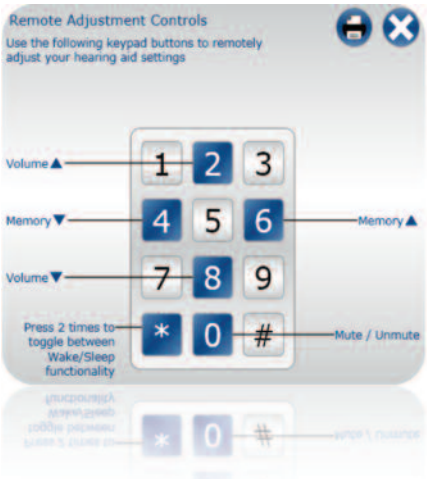

Figure 1. Remote adjustment controls.

Figure 2. Audiogram influenced environmental sound simulator.

and ugly" and that they "looked like the hearing aids their grandparents would wear."[2] We have made considerable strides to insure that hearing aids are sleek and attractive, that they are functional AND beautiful

Another area where manufacturers have assisted the consumer is on the managing of difficult listening situations. Certainly, the hearing aid doesn't tell the patient which position in a crowded room would be acoustically advantageous (yet, but give us a few years!) but they do assist in reducing the detrimental effects of background noise. Built in algorithms allow for better classification and alteration of the acoustic signal being fed to the patient. Current algorithms allow for analysis of: (a) Overall Input Level; (b) Steady-State Input; (c) Modulated Input; (d) SNR Calculation; (e) Omni and Directional Path Power Estimate; and (f) Magnetic Field Detection in order to provide classification into six different "AudioScapes" (Quiet, Mechanical Noise, Wind, Noise, Speech and Noise and Speech) with a variety of programming options to accommodate a patient's unique listening environments. The patient's hearing aid does the work that the patient would have to be trained to do.

And what types of hearing aids are patients selecting? Receiver-in-the canal hearing aids have become an increasing large percentage of the products selected by patients in Canada. In addition, consumers are getting the message that higher end technology is worth the cost, that the additional features and options assist the consumer. During the past few years higher end technology had crept upward in percentage with approximately 21% of all hearing aids sold high end technology. Clearly this means that a great number of patients are not taking advantage of this technology but at least the trend is going in the positive direction!

So where else can the consumer do better? They can be sure to include their family members in the fitting process. And if they don't, we as the consumer can encourage the family members to participate and to make sure that they understand the issues confronting the consumer. One easy way to demonstrate this issue is through the use of a hearing loss simulator. Simulators are available in a variety of formats.

An example is shown in Figure 2 of a simulator that can demonstrate how loud variety of environmental sounds or recorded speech sound with the patient's own audiogram.

Another area of potential improvement would occur if consumers would become better gatherers of information and therefore more informed consumers prior to arriving at the audiologist's office. While numerous websites exist specifically designed to educate consumer and encourage them to see an audiologist (see freehearingtest.ca), in a study performed by Antenna research for Starkey Labs, it was noted that baby boomers were MOST likely to obtain information about their hearing losses from their family physicians.[2] Now we know that while many family physicians are very up-to-date on the latest issues in amplification, others are not so it is not the ideal place for a consumer to gather information. In the interim, educating family physicians in our local areas might be an approach to insuring that the consumer becomes, in term, a more informed consumer before entering into the evaluation process.

B. RESPONSIBILITIES OF THE AUDIOLOGIST

Ten years ago I had six recommendations for the audiologists. They included: (1) The responsibility of the

Figure 3: Integrated real ear.

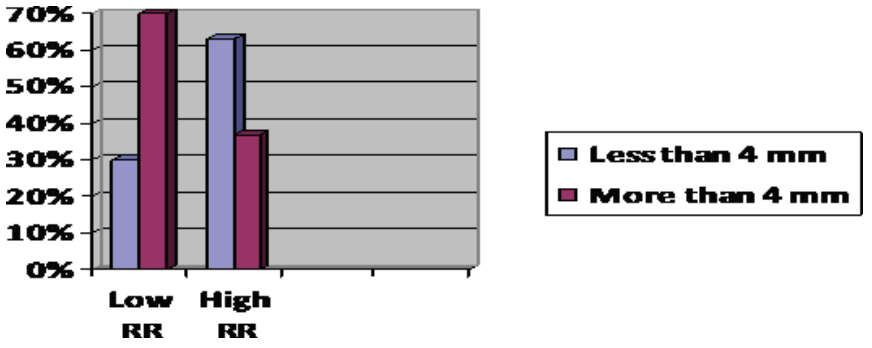

Figure 4. Remake rates.

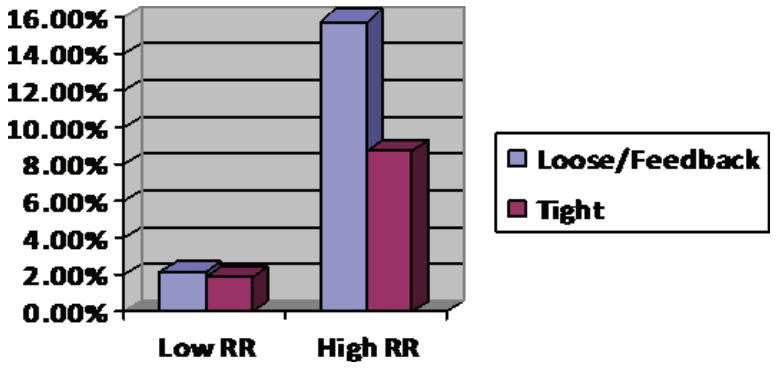

Figure 5. Loose and tight fit remake rates.

audiologist to take time to perform testing required to order, select and fit appropriate amplification; (2) The responsibility to remain current in our field; (3) The responsibility to inform patients regarding assistive listening technology; (4) The responsibility to behave professionally at all times; (5) The responsibility to promote our profession; and (6) The responsibility of keeping costs low by providing skilled services, thereby eliminating need for "remaking" hearing aids or repeating procedures over and over. Ten years later, how are we doing? I think we have made considerable progress in some areas.

Manufactures have assisted the audiologists in some of their duties. Integrated/live real ear techniques have been offered as part of the fitting process (see Figure 3). We have included better "best fit" algorithms which have been tested on patients and for which data exists to validate their existence. Both of these additions allow audiologists to provide more efficient and therefore less costly service to their patients. An interesting event that has occurred during the past 10 years is that return rates, for the first time, have lowered substantially to 12.40%.[3]

In his discussion on the reasons behind lowered return rates, Strom hypothesizes that much of this lowering has to be due to "better educated and skilled personnel who are using better-fitting and better-performing digital hearing aids." He continues with the point that using nonlinear fitting rationales do a better job in approaching final targets and that many hearing care professionals now feel more comfortable with advanced technology. He also points out that the use of high viscosity impression materials along with impressions that extend beyond the second bend has played a role in this return rate reduction. A study conducted at Starkey Canada helps to illustrate the importance of this on improvement. Ear molds for new orders were coded to determine if they were taken at least 4 mms beyond the second bend and judged to be an adequate impression without pits or voids. Dispensers were divided into two groups: Those with lower than average remake rates and those with higher than average remake rates.

As can be seen in Figure 4, for the group with the lowest remake rates, 70% of the impressions met the criteria of being at least 4 mm beyond the second bend and an impression without pits or voids. When we look at the same two groups

return for remakes we can draw the conclusion that the impression and skill taking the impression does matter. Returns for remake for both loose fits and tight fits were lower for those whose impressions were typically longer (shown in Figure 5)

What more can we do? We can offer additional information to consumers. Kochin found that patient satisfaction with amplification increased significantly as the amount of instruction time increased.[4] Certainly, use of aural rehabilitation has been linked to reduced return rates. Northern et.al. reported data gathered by HearEx using a program entitled Hearing Education and Listening Program (H.E.L.P) in which recently fit patients were encouraged to attend three aural rehabilitation sessions.[5] Sessions included:

Class 1. Hearing Loss and Hearing Aids
- The hearing process
- What to expect from your hearing aids
- Use and care of hearing aids
- The value of binaural amplification

Class 2: Overcoming hearing loss
- How to overcome and accept hearing loss
- Tips for communicating effectively
- Learning to listen

Class 3: Total communication
- Cues to help speech understanding
- Controlling the listening environment
- Hearing enhancement products

Data was gathered for 73 centers located in five states and information was gathered over a seven year period on a total of 7,178 patients. While only 42.3% of all newly fit patients completed the entire 3-week rehabilitation course, the return rate for those who did attend was only 3% – substantially lower than the average.

Kochkin reported the use of *Consumer Handbook on Hearing Loss and Hearing Aids* in a rehabilitation program.[4] Thirty-one dispensers participated in the project with 289 patients assigned to read three chapters of the book. Book chapters were assigned based upon concerns raised in the rehabilitation courses. Of those who participated in the classes, the return rate was 8%. Of those who participated AND read the chapters, the return rate was only 3.3%. While I challenged concerns regarding becoming educated about their hearing aids, such programs clearly show that audiologists can facilitate that process through rehabilitation programs which notable results.

An article by Sweetow et al., went so far as to be entitled "WARNING: Do NOT add on Aural Rehabilitation or Auditory Training to your Fitting Procedures."[6] Obviously, this group was not advocating against the use of aural rehabilitation or auditory training, rather that they are "integral components of the holistic approach we should be providing our patients." They can't just be considered add-ons that we use when we feel as if we have the time. They must be a part of every fitting for every patient.

So where else haven't we made any improvement in the past 10 years? I believe in the area of assistive listening devices. As I wrote 10 years ago "It is the responsibility of the audiologist to discuss, explore and demonstrate Assistive Listening Devices (ALDs) with every patient. ALDs aren't highly profitable when sold and they take a large amount of time to discuss, explore and demonstrate. Yet, ALDs can often make or break a patient's ability to function in a given environment. The satisfaction of knowing patients are communicating well is worth the extra time and effort".

Figure 6a. Standard modeling.

Figure 6b. Comfort fit modeling.

C. RESPONSIBILITIES OF THE MANUFACTURER

Ten years ago I stated that manufactures had five core responsibilities: (1) The responsibility of the manufacturer to provide audiologists with increased fitting flexibility; (2) The responsibility of the manufacturer to address problem areas such as cerumen; (3) The responsibility of the manufacturer to provide a decent price for their technology; (4) The responsibility of the manufacturer to develop better fitting tools and paradigms; and (5) The responsibility of the manufacturer to provide outcome data.

We know that major improvements have been made in the industry during the past 10 years, improvements on feedback reduction, improvements in algorithms to correctly identify and reduce issues with noise, improvements

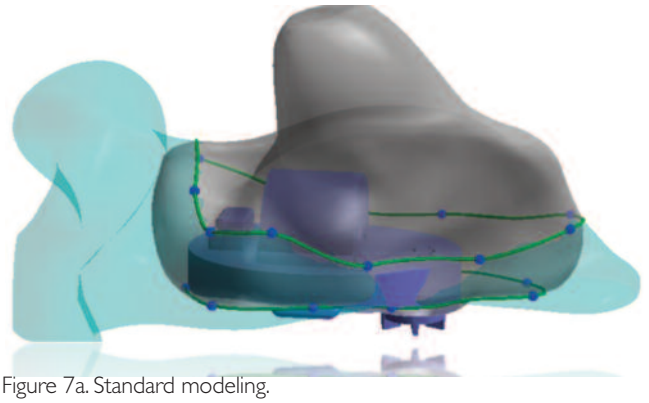

Figure 7a. Standard modeling.

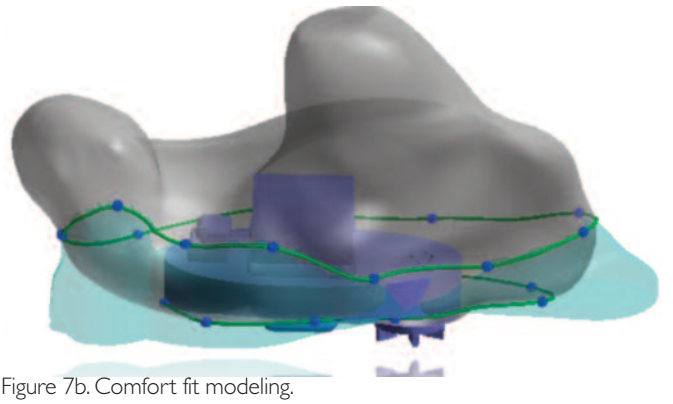

Figure 7b. Comfort fit modeling.

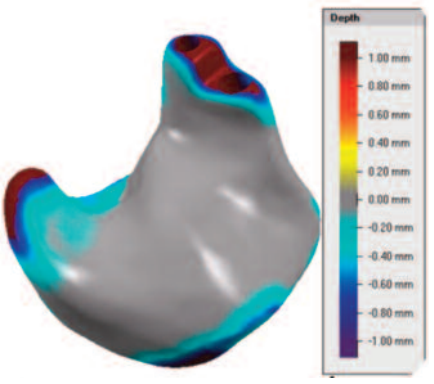

Figure 8a. Standard modeling.

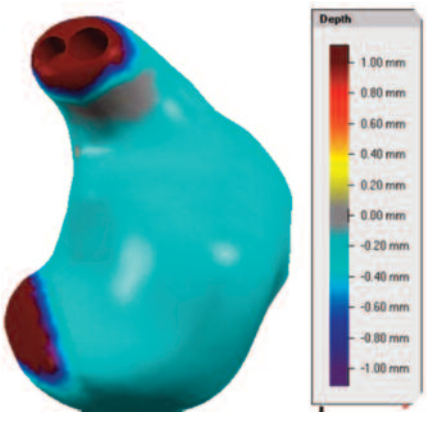

Figure 8b. Comfort fit modeling.

in listening specific configurations. Let's just look at one example of how technology had changed the way patients are fit: Purewave Feedback Eliminator (a feedback management algorithm from Starkey) now offers 25 dB of additional amplification without feedback. With such increases not only do patients have less issues with feedback, but it has lead to a new manufacturing process we call Custom Comfort Fit (shown in Figures 6 and 7).

If we look at current canal aid moduling, you will see that the canal length is very long when compared to the new moduling. Longer canals have been used historically to reduce feedback but with the strides made in feedback reduction, shorter canal lengths can be employed that has been found to improve comfort.

If we look at another area of difficulty – fitting full-shell aids – we know that much of the difficulty and a great number of the returns for this style of product lie in the inability to insert the insturement. By reducing the shell size-essentially making a full-shell a ¾-shell, we reduce many of the contact areas for difficulty insertion.

One more example of how a feedback reduction circuit and allow for improvements for the manufacturing process. In the current modeling process, a thickness of .03 is added to the entire shell with post processing adding another .11 for a total of a thickness of approximatley three post-it notes. This process, historically, has been added to insure lack of feedback. The current process strinks the shell -.10 to negate the post process of .11 with only the acoustic seal region remaining with the .11 post process addition. This allows for a "truer" fit and reduction of remakes due to uncomfortable fit (Figure 8).

Another area we have made great strides in in manfucaturing is the introduction of evidence based design. We no longer can claim that our hearing aids will walk the dog and take out the garbage – or at least if we make that claim we have to evidence that they do so. Starkey introduced a new web site entitled starkeyevidence.com that allows for

individuals to go on line and not only see the documentation that is used to submstanticte our claims but also show how the studies were conducted with enough detail to allow for the claims to be reproduced. For example, the study that compared Starkey's integrated real-ear system with stand-alone real-ear systems is on starkeyevidence.com so that the raw data can be viewed and the procedure can be duplicated by anyone who is interested in doing so.

So where can manfucturing do better? Certainly the issue with cost remains with many consumers siteing cost as an issue for lack of hearing aid use. Issues with cerumen remain (and I am afraid will always remain) regardless of how hard manufacturers try to reduce issues with cerumen. We have made improvements on moisture issues-introducing water resistent hearing aids. We can continue to work on our best fit algorithms and provide transparent algorithms so that it is readily apparent what controls alter which hearing aid characteristics. We have room for growth during the next 10 years!

SUMMARY

All in all, the past 10 years have been a time of substantial improvement for all three concerned parties: the consumer, the audiologist and the manufacturer. At the time I wrote the article 10 years ago, it seemed to me that meaningful relationships between these three groups happened seldom, and yet the last ten years have brought us an increased understanding that we are all in this together. Blaming the manufacturer for failure or the patient for not trying hard enough seems to have decreased. We are working together more successfully. Here's to the next 10 years!

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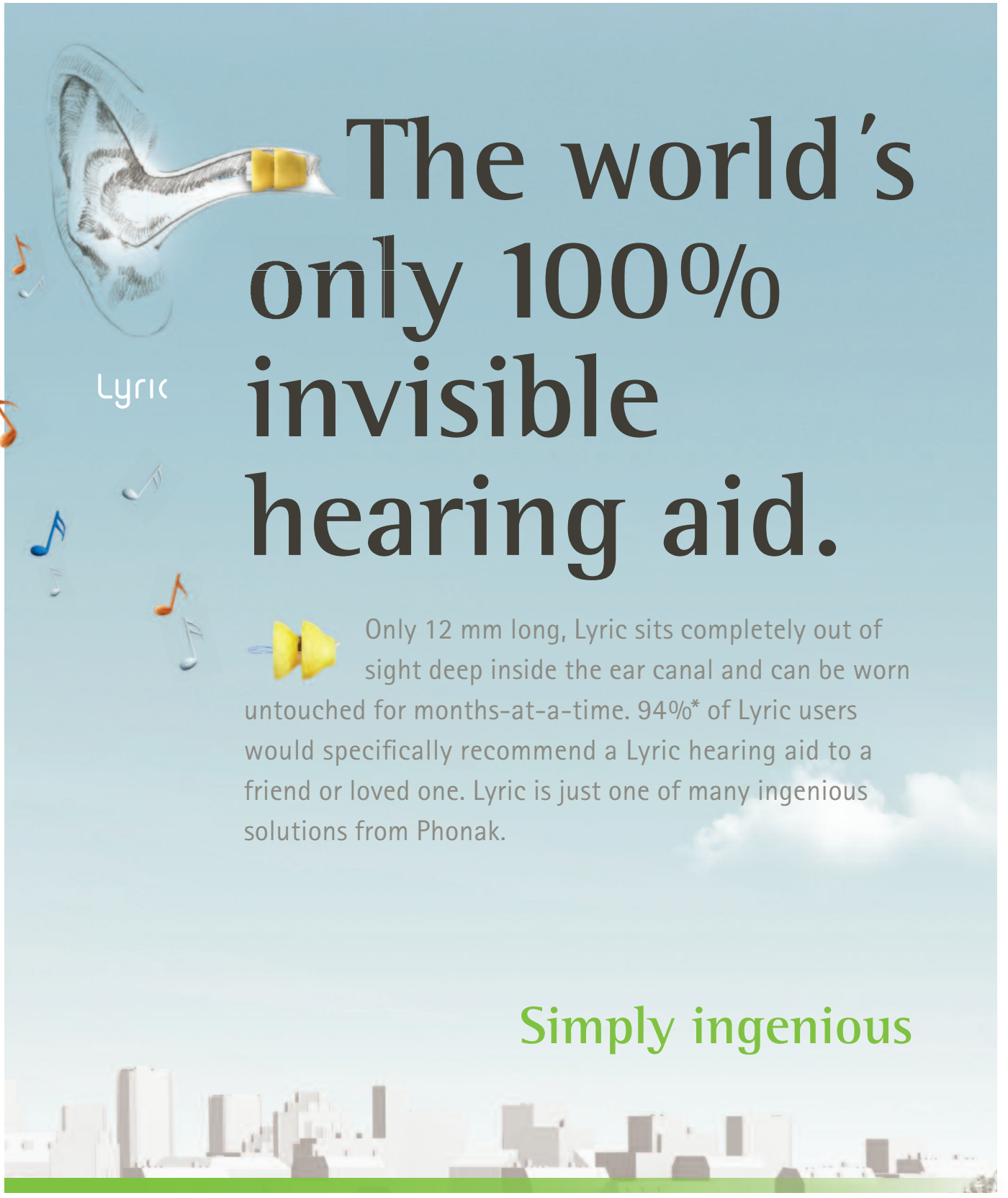

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