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The CROS Hearing Aid: Ends and Beginnings

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Editorial Comment

In July 2015 I published a Back to Basics column in Hearing Review about Contralateral Routing of Signal (CROS) hearing aids (article #1 below) and it is reprinted with permission. The article reviewed the history of the CROS hearing aid beginning in the 1960s when it was first marketed. Neil Bauman, PhD, a widely published author on hearing health and the owner/curator of "[The Hearing Aid Museum](#)," reminds us (in article #2 below) that the CROS idea even preceded the Harford and Dodds innovation of the 1960s.

Obituary: The CROS Hearing Aid (1964-2014)

By Marshall Chasin, AuD

The CROS hearing aid, just 50 years old, has been laid to rest. It died peacefully after a prolonged change in the hearing aid industry that has relegated the once proud CROS hearing aid fitting to merely one that is equal to one of setting frequency response or gain. With modern technology, one can merely “program” a hearing aid to be able to communicate with its “pair” that sits on the opposite side of the head.

Based on a 1964 patent by Harry Teder at Telex, using a “sound tube” from one ear to the other, the first contralateral routing of signal (CROS) was accomplished.¹ The patent did not mention a microphone on the opposite side of the head—the basic concept of a CROS. However, a year later, in 1965, Harford and Barry² introduced CROS and BiCROS hearing aid fittings. Telex introduced a wireless eyeglass in 1975 and it proved to be very successful.

Wireless ear-to-ear technology was first introduced in 2004 by Siemens and was called e2e.³ At that time, it allowed a hearing aid user to be able to select a control on one hearing aid that simultaneously controlled some aspect of the other hearing aid. This early version was able to send a series of instructions from one hearing aid to the other hearing aid in a binaural fitting, such as the setting of compression features, and later, some features used in the setting of directional hearing aid characteristics. More recently, this included the desirable feature of being able to set the volume control on one aid that controlled both hearing aids, and a program switch in the other that controlled both hearing aids—a feature that is now available even in the small CIC hearing aids.

This “latest” wireless innovation, now a decade old, is ubiquitous in the hearing aid industry. One can listen to a telephone on one ear and receive a binaural signal in hopes of improving telephone communication. Virtually all hearing aid manufacturers now offer this capability.

And recently, wireless technology has progressed to a point where not only is control information being routed from one ear to the other, but the entire audio spectrum. One can program a hearing aid to have this full-spectrum wireless capability and the other to receive this wireless information. This is what the field has traditionally called the CROS (or BICROS) hearing aid.

If this is now a standard in the industry, CROS and BICROS fittings are now accomplished with little more than pushing a button or two in the programming software. In a CROS fitting, one would use software to turn off the hearing aid receiver in the “unaidable” ear and implement wireless communication to the other ear where the microphone has been disabled. In a BICROS fitting, both microphones would be left on. No longer are specially designed hearing aid shells and receivers required for a CROS/BICROS fitting. Two features of this new technology are apparent:

- 1) Setting up a hearing aid as a CROS or BICROS is equivalent in time spent to program a pair of hearing aids with all of the gain and output features being specified. It takes a similar amount of time as any other series of settings that are part of the fitting process.
- 2) The hearing aid on the “unaidable” ear is now a fully functional hearing aid and can be programmed as a CROS/BICROS or as a monaural hearing aid. All of the components and software found in any other hearing aid are present. Subsequently, the “second” hearing aid for the “unaidable” side is billed to the dispensing professional as another (second) hearing aid with its unique serial number and warranty information.

Given this reality, some manufacturers now sell a CROS or BICROS “hearing aid” as two separate hearing aids that, depending on the software settings, can be either two functional hearing aids in a binaural fitting or alternatively set up as a CROS or BICROS fitting. This is no different than selling two hearing aids where some characteristics can be wirelessly communicated between the devices in a binaural hearing aid fitting. With a potential CROS or BICROS hearing aid fitting, the dispensing professional is now billed the cost of two separate hearing aids.

The question arises whether the consumer or a third-party funder should pay for two hearing aids or for one hearing aid, or for something in between? Even if the hearing aid manufacturers charge two unit costs for the two hearing aids, should there be two full dispensing fees appended to the final cost of the hearing aid(s)?

Both hearing aids can be programmed to stand alone as fully functional hearing aids, and both hearing aids require software programming (and clinical time) by the hearing care professional. They also come with individual warranties and individual invoices, as if two hearing aids were dispensed. And it takes about the same time to program a hearing aid as a CROS or BICROS fitting as it does for a “conventional” between the ears wireless hearing aid fitting.

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CROS Hearing Aids Existed before CROS Hearing Aids Were Even Invented

By Neil Bauman, PhD

The concept of a CROS (Contralateral Routing of Sound [or Signal]) hearing aid is simple. Route the sound from the “deaf” (worse hearing) ear to the “good” (better hearing) ear. The result is that people who are deaf or hard of hearing in one ear can now better hear what people are saying from their “deaf” side.

Harry Teder of Telex Corp. patented this concept back in 1964, and the first CROS aids were fitted the following year.¹ This is all well and good, but the truth is, CROS hearing aids had already been in use for 10 years by this time without anyone even realizing it! Let me explain.

With the invention of the transistor and its first use in hearing aids beginning in December, 1952, hearing aids rapidly shrank in size. This was because transistors, even the early ones, were still much smaller than the miniature vacuum tubes they replaced. In addition, eliminating vacuum tubes also eliminated the large “B” battery that these vacuum tubes required to “run.”

The result was that just 2 years after the first hearing aid containing a transistor came out – the body-worn Sonotone Model 1010 – hearing aids had shrunk so much that the electronic components could now be hidden inside the temple-pieces of eyeglasses.

However, the components were still too large to all fit into just one temple-piece, so the manufacturers put some components in each temple-piece. The four biggest components were the microphone,

volume control, receiver, and battery. They put the microphone, volume control and electronics in one temple-piece and the receiver and battery in the other.

This arrangement had a big advantage. It totally eliminated feedback as the microphone and receiver were separated by 7" or 8" (18 – 20 cm) and were on the opposite sides of the head. However, by using this arrangement, the result was, in actuality, a CROS aid – the sound was picked up from one side of the head and delivered to the opposite ear.



Otariion introduced the first eyeglass hearing aid using transistors, their Model L10 "Listener" (Figure 1), on December 9, 1954. It went on sale in January, 1955 and thus had the distinction of being the first CROS aid – a decade before the concept was supposedly invented.

These new eyeglass CROS hearing aids quickly became popular and by 1961 no less than 33 different hearing aid manufacturers had come out with their own versions of these CROS eyeglass hearing aids.

Figure 1. Otariion Model L10 "Listener" Interestingly enough, there were two basic styles used in eyeglass hearing aid—the world's first these early CROS eyeglass hearing aids. The first style transistorized eyeglass hearing aid. Note the had large, heavy-looking temple-pieces with the thick, heavy temple-pieces. Both were electronics housed throughout their length. An example of this style was the Otariion L10 "Listener" (see Figure 1).

The second style had more or less regular-looking temple-pieces with the hearing aid electronics all housed in



the temple-piece Figure 2. The Acousticon Model A-230 tipseyeglass hearing aid showing how the behind the electronics were all contained in the tips of ear. Thus the temple-pieces.

from the front and side, these hearing-aid eyeglasses looked

“normal” and the hearing aid part was generally invisible – buried in the hair. An example of this style was Acousticon’s first eyeglass hearing aid, their Model A-230 that came out in 1955 (Figure 2).

As you can see, instead of having the electronics spread through the length of the temple-pieces, they gathered them all into two enormous (by today’s standards) behind the ear tips of the temple-pieces (Figure 3). The microphone, electronics and volume control were housed in the right temple-piece while the battery and receiver were housed in the left one (see Figure 2).

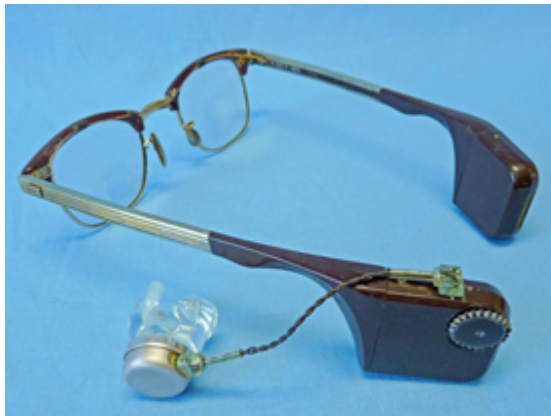


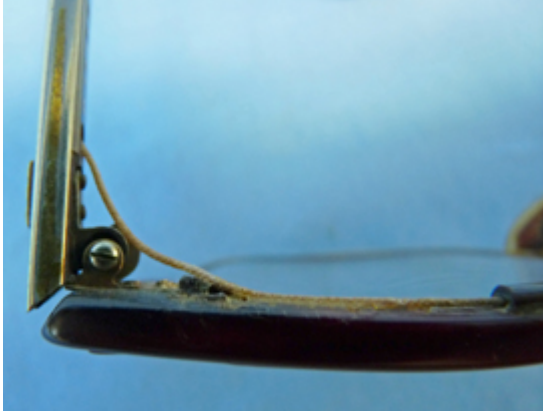
Figure 3. Radioear's Model 840 "Lady America" eyeglass hearing aid. In this case the receiver, volume control and electronics were in the left temple piece and the battery and microphone in the right one. They could be unplugged and interchanged at will.



Figure 4. The Radioear Model 840 eyeglass hearing aid pulled apart to make a body-worn hearing aid. The aluminum face-plate (left) was sandwiched between the two parts.

Not to be outdone, Radioear came out with their Model 840 “Lady America” eyeglass hearing aid (Figure 3) in a similar style but with a twist. You could unplug the two parts of this hearing aid from the temple-pieces, plug them into each other and viola – you had a body or barrette hearing aid (Figure

4).



One problem the engineers had to overcome was how to send the sound signals and power from one temple-piece to the other. Their solution was to run two wires from the frame end of the temple-piece across the frame and nose bridge to the opposite temple-piece. To do this, they used one of two methods. The simplest way was to design the frames with a groove – typically across the top of the lenses and the inside of the bridge to the other side. The wires could be “loose” at the hinge (Figure 5) or more hidden. The weak point with this arrangement was that

Figure 5. Radioear Model 840 eyeglass opening and closing the glasses each day could cause the hearing aid showing how the wire threaded wires to break at the hinge.

around the hinge and fitted into a groove along the top of the frames.

A more elegant solution was to make the wires in three sections – one for each temple-piece and one for the eyeglass frames. To make contact with each other at the hinge, they used an ingenious arrangement of two pins and two plates (Figure 6). When the glasses were folded, the pins and plates didn’t touch so it automatically turned the hearing aid off. When you opened the glasses to wear them, the pins touched the plates again and turned the hearing aid on.

One drawback of needing both temple-pieces is that you could not have a binaural fitting. This didn’t seem to be too much of a problem in the mid-1950s as they seldom used binaural fittings at that time. They figured that hearing in one ear was good enough.



However, it didn’t take long for components to shrink further, and by October, 1956 both Acousticon and Beltone had come out with eyeglass hearing aids that had all the components in just one temple-piece. Notice that the Acousticon Model A-235 (Figure 7) and the Beltone “Hear-N-See” (Figure 8) still had the

Figure 7. The Acousticon Model A-235 heavy-looking temple-pieces – eyeglass hearing aid only required one it’s just that all the components temple-piece. This is an example of the first were contained in one temple-



Figure 6. Close-up view of the hinge area of the Otarion Model L10 eyeglass hearing aid showing the black “pins” (left) and “plates” (right).

hearing aid to have a separate hearing aid inpiece. The opposite temple-piece each temple-piece.

could be a separate hearing aid (shown in Figures 7 and 8), or it could be a matching “dummy.” Now people could wear binaural eyeglass hearing aids.



Figure 8. The Beltone Hear-N-See eyeglass hearing aid was another early hearing aid that only required one temple-piece. This example also had a separate hearing aid in each temple-piece – quite a rare occurrence back in the mid-1950s.

Thus, the demise of the early eyeglass CROS hearing aids began within 2 years of their first coming out. By 1958 almost all eyeglass hearing aids only used one temple-piece, although bone conduction eyeglass CROS hearing aids requiring both temple-pieces stuck around a bit longer – until 1961 or so.

So that is how CROS hearing aids existed a decade before CROS aids were invented. As Paul Harvey used to say, “Now you know the rest of the story.”

Reference

1. Chasin M. Obituary: [The CROS Hearing Aid \(1964-2014\)](#). *Hear Rev* 2014;21(5).