Canadian Audiologist

The Official Publication of the Canadian Academy of Audiology

Disposable Hearing Aid

Published September 10th, 2015

Wayne J. Staab, PhD

Dr. Staab was in on the ground floor when this project was initiated, working with Sarnoff Research Institute, starting in 1997, and continuing throughout its development.

A disposable hearing aid was introduced in 2000 By Songbird Medical.[1] It was designed, developed, and financed by the Sarnoff Research Institute, formerly RCA Laboratories in Princeton, NJ, which is a research "think tank" employing in excess of 400 Ph.D. scientists/researchers. Financial backing for the project came from several corporations, including Bank of America, Johnson & Johnson, and the University of Texas.

The hearing aid was designed as a one-size fits most individuals, having a fixed housing, but with various soft tip diameters to accommodate different size ear canals, and that would fit either ear (Figure 1).



The instrument was designed for mild and moderate hearing losss. The goal was to develop a hearing aid that would overcome many of the hurdles causing many hearing impaired to delay wearing amplification and allow this with minimal involvemenrt for entry into the system. The disposable hearing aid was intended to overcome consumer concerns related to:

- Cost
- Ease of use
- Ease of product selection
- No ear impression required
- Same-day fit and results
- Easily switched from one ear to the other
- Elimination of the occlusion effect
- Eliminate repairs
- Eliminate battery replacement/maintenance
- Eliminate remakes
- No shipping of ear impression to manufacturer and waiting for the finished product to come back and finally be tested

Generally, the product was designed to overcome the list of “problems” occurring with custom-molded hearing aids

The product was designed to compete in quality with the industry’s best and most expensive instruments, but easily obtainable at a very low cost of entry - $39 to the consumer for an estimated 60 days of usage. That meant getting material costs under $7.00 per unit. The device components were completely different from those in hearing aids at the time, including a new micropone, receiver, and non-accessible power source that was designed specifically for the instrument. All Songbird models incorporated two-channel compression with a fast attack time and moderate release time. There was no volume control.

Several different models of the Songbird were available, each having a different “prescription” to suite a specific type (or range) of hearing loss (fixed frequency responses).[2] The study evaluated multiple samples of seven different models.

Totally Automated Assembly

The Songbird was designed to be assembled via computerized automation. Once the switch was turned on, there was no human involvement, with complete (start to finish) assembly taking less than 10 seconds per unit. Such assembly techniques ensure consistent processing, resulting in a very low reject rate. Assembly was geared to a six sigma rejection (one per one thousand).

Why Disposable?

Being disposable means that there are no repairs, replacement of batteries, and it eliminates the concern of purchasing soon-to-be outdated technology. Additionally, the consumer receives a totally new hearing aid every two months. Making a product disposable also affects the material cost because there is no need to design the product to last five years or so, and makes losing an instrument much less of a fear factor because the replacement cost is minimal – the cost of a new aid. The expectation was that such a product, easy to obtain and use, would result in significant first time visits to a hearing aid professional, and as a result, expand the hearing aid market.

So, What Happened?

Songbird, as originally designed did not survive, the reasons being varied.

1. The design, to be interchangeable between ears, resulted in a slightly different cosmetic appearance (faceplace angle) in the right versus the left ear. This was not a major issue.
2. The instrument did not fit as many ears as originally expected. Results showed that small ear canals had difficulty with fit and comfort, with acceptable fit and comfort for small (female) ears ranging from 40% (9 mm tip) to 75% (8 mm tip), and for all subjects 60% (9 mm tip) to 82% (8 mm tip), with an *n* of 99.
3. The decision was made to dispense the product through the professional community – to provide dispensers with a product that would encourage entry into hearing aid use. The product and concept was rejected by the professional community from the very start. Selling a product to a consumer at $39 (US), with a gross profit of $10, did not set well against a gross profit of $1000 to $2000 per unit, even though repeat sales (with essentially no involvement) provided an additional line item profit with little or no additional overhead cost, and would provide a somewhat similar revenue stream over time as did premium priced instruments, especially considering that overhead costs would be lower (no repairs, frequent patient contact, opportunity to sell up, etc.). Regardless, the product was criticized harshly, often by those who had never touched or fit the product. Had the product been sold over-the-counter, as an alternate approach, the result may have been different. Individuals who wore the instruments were pleased and

repurchased. The problem was that many were not offered the opportunity, but instead, were discouraged from even trying.

Songbird Performance

Did the Songbird achieve its goal of meeting the amplification quality of the premium products at the time? The answer was yes. A technical review of the Songbird, commissioned by Defeating Deafness (United Kingdom), and conducted by Brian Moore and his colleagues at the Department of Experimental Psychology at the University of Cambridge, examined a representative sample of the units.[3] Salient information is as follows:

For some of the measurements, comparisons are made with: (a) A “typical” NHS aid (BE19); (b) A high-quality digitally programmable analogue aid incorporating two-channel fast-acting compression; (c) Two digital aids representative of “high end” products, costing in excess of £1500 each. These two aids both incorporated multi-channel fast-acting compression together with systems for noise reduction and feedback management. However, the noise reduction and feedback management features were disabled while the measurements were made. This was necessary, as these features tend to reduce the gain when steady signals, such as sinewaves, are used to make measurements. The battery life of the comparison aids was typically 5-7 days. They used either size 312 or size 13 batteries.

The comparison aids were set up to have (within the available limits) a target response appropriate for a moderate sloping hearing loss (greater loss at high frequencies).

Conclusions

- The Songbird hearing aids performed well in all of our measurements. They provide frequency-dependent amplification of an appropriate form for people with mild to moderate hearing loss, and their frequency response has the desirable characteristics of being smooth and covering a wide frequency range. In fact, the effective frequency range was wider than that of any of the comparison aids tested, including two digital aids.
- The levels of microphone noise and circuitry noise in the Songbirds were unusually low. In fact, they were lower than for any of the comparison aids.
- The amount of compression is appropriate for people with mild to moderate hearing loss.
- For a given model of the Songbird, the performance is very consistent across samples. This means that the user of Songbirds will not notice any marked difference when disposing of the old aid(s) and starting the use of new one(s) of the same type.
- The performance of the Songbird aids does not deteriorate towards the end of the battery life.

Summary

It is interesting to speculate about what might have occurred if today’s component sizes would have been available at the time of the Songbird development. That certainly would have eliminated any physical “fit” and “comfort” problems. However, the issue of distribution was the primary reason for failure, not product quality or performance.

A product before its time? Quite possibly.

References

1. Staab W, Sjursen Preves D, and Squeglia T. A one-size disposable hearing aid is introduced. Hearing J 2000;53(4):36,37,40.
2. McCandless G, Sjursen W, Preves D. Satisfying patient needs with nine precision

acoustical formats. Scottsdale, AZ: American Auditory Society; 2004.
3. Moore BCJ, Stone MA, and Alcåntara JI. Technical revidw of the Songbird™ disposable hearing aid, 16-page detailed report, 2001.