# Field Study News

## New wire curvature from Phonak

### Like custom-made

## Overview

**In recent years, hearing systems with external receivers (known as Canal Receiver Technology, CRT) have become increasingly widespread, as well as the selection of pre-shaped wire connections. In addition to audiological performance, a key factor for an overall positive impression of, and client satisfaction with, a CRT hearing system is the fit in and around the ear.**

**This study assessed the fit of the improved wire curvature for Phonak CRT hearing systems with 19 test subjects fit bilaterally and compared it with three competitive systems using a standardized set of criteria for evaluation.**

## Introduction

In addition to audiological performance, the cosmetic appearance and comfort of an open-fit hearing system are the most relevant factors in the client's purchasing decision (Mueller, 2006).

To ensure wires are bent in the most ideal curvature between the receiver and the hearing instrument, four sections have been identified as being relevant to an optimal fit, as shown in Figure 1.

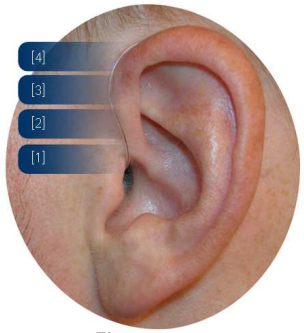

Figure 1

- **Section 1:** The wire should be curved so that it is discreet and as close to the ear as possible after exiting the ear canal through the anterior notch and then routed upward, parallel to the helix. It is also important that the receiver is positioned well in the ear canal, which is determined by the curve and the dome.
- **Sections 2 and 3**: The wire should not protrude from the ear, therefore to reduce visibility from the front, it should be as close to the head as possible over its entire length and not routed over the ear. If this is not the case, it can be visible at various spots and cause pressure points. In some situations, the receiver cannot rest correctly in the ear canal because of tension and being pulled or pushed. Ideally, the wire should touch the head and run upward, parallel to the helix, in sections 2 and 3.
- **Section 4:** The wire should curve over the top of the ear, closely following the shape of the ear, to keep visibility to a minimum. Moreover, the curvature should allow the hearing instrument to sit behind the pinna with the directional microphones in a horizontal position.

With the goal of continually improving products, the design department at Phonak used these assumptions as the basis for developing the new receiver wires.

## Methods

At the Phonak Hearing Center in Stäfa, Switzerland, wire curvature was assessed using a defined set of evaluative criteria during the field testing for Audéo SMART and MINI. Testing involved only observations made by the four investigators, without any active participation by the test subjects. The Phonak hearing instruments were assessed based on how well they corresponded to the individual anatomy as per the four sections illustrated in Image 1 and compared to three competitors' systems.

This method was applied to all 38 ears with all hearing systems.

## Test subjects and instruments

Nineteen people participated in the study to assess wire curvature. The average client age was 66.5 years (age range: 43-78 years). The new Phonak measuring gauge for slim tubes and CRT receivers was used to measure wire length. For assessment of fit on the ear, only standard receivers were used with Audéo SMART & MINI hearing systems for comparison, as not all manufacturers offer power receivers with their hearing instruments. Open domes in adequate sizes were placed on all receivers.

## Results

Wire bending results for the right and left side were compiled for each section for a clearer comparison.
In position 1, the Phonak CRT receivers did not meet the criteria in only two ears (Fig. 2). Manufacturers A and C had similar results. However, the wire curvature of manufacturer B clearly failed the criteria in 50% of all ears, as the wire exited the ear canal with an excessive radius and, as a result, did not follow the shape of the helix. Internal studies have shown that the wire needs to exit the ear canal at an angle of approximately 30° in the direction of the face to match the shape of the ear.

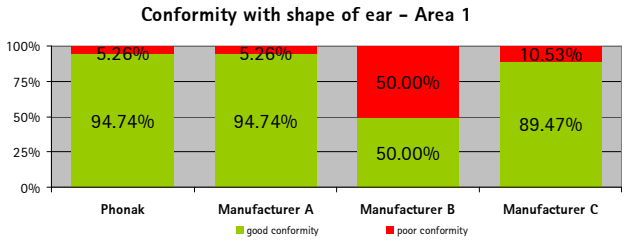


**Figure 2**: Matching the shape of the ear - section 1

In section 2, the wire should continue to follow the shape of the ear and pass the lower section of the helix at an appropriate angle. Negative results were reported when the wire was routed directly upward and lay atop the helix or when the angle caused excessive curvature (Fig. 3).

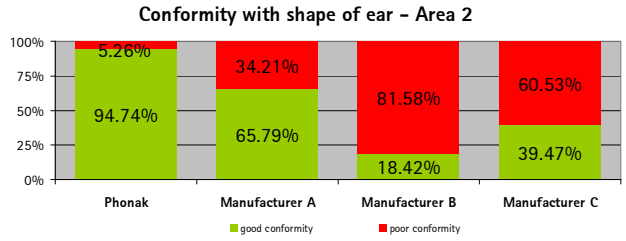


**Figure 3**: Matching the shape of the ear - section 2

With the wire bending from Phonak, deviations from the ear shape could be documented in only 2 cases. The wire bending of manufacturers A, B and C did not meet the criteria and in part, failed this section; wires protruded excessively and were clearly visible. Data analysis showed that the criteria was not met in approximately 34% of all cases for manufacturer A, approx. 82% for manufacturer B and approx. 61% for manufacturer C. This effect is pronounced in test subjects with small ear canals if the receiver cannot be fully inserted due to its cross-section.
The criteria for the next section of wire around the helix (section 3) were mostly met (Fig. 4). However, it should be noted that for this section, the wire curve from Phonak provided an optimal fit in all cases.

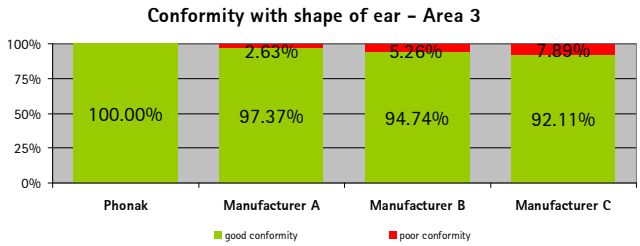


**Figure 4**: Matching the shape of the ear - section 3

Most manufacturers had a good solution for wire bending in the uppermost section, the curve in section 4 over the pinna (Fig. 5). Only manufacturer B's wire bending was unsatisfactory in 20% of all cases, as the radius was too large, by comparison, and the wire protruded from the ear in some cases.

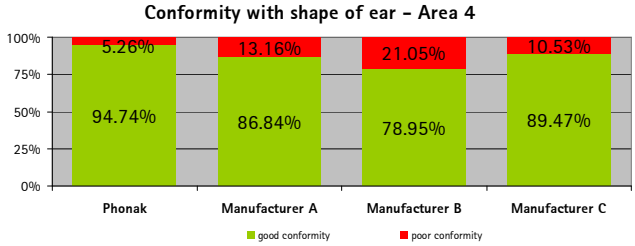


**Figure 5**: Matching the shape of the ear - section 4

## Discussion

All systems evaluated were standard, instant-fit solutions which, unlike customized earmolds, are designed for use with a variety of ear shapes.
Study results show that the improved Phonak CRT wire provides an optimal ear fit in almost 85% of all test subjects. By comparison, the wire bending of manufacturer A fit the contour of all parts of the outer ear in only 21% of the subjects, manufacturer B, 10% and manufacturer C, 18%. Systematically analyzing the four sections during product development has resulted in a new Phonak wire curvature suitable for almost every ear shape.

## Literature

Mueller, 2006, Hearing Journal: Open-Canal Fittings: A Special Issue. 59 (11), 11-14

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