Field Study News

May 2017

Small custom hearing aids, thanks to titanium

Introduction

When it comes to hearing aids, small is a big topic: 62% of non-users report that having an invisible device is their top priority.[1] Phonak is using an innovative shell technology that allows smaller design of custom hearing aids. Titanium is a premium material whose inherent properties are already leveraged by a variety of industries; it can be found in medical and dental implants, high-tech sport equipment, luxury jewelry, and high performance vehicles. Generally speaking, titanium is 15 times stronger than acrylic, the industry standard for custom shells. The inherent strength of the material allows it to be manufactured at half the thickness of current industry standard IIC acrylic shells. With a 50% thinner titanium shell, the Virto B-Titanium (see figure 1) is the smallest ever custom product from Phonak.

Figure 1. Virto B-Titanium.

Methodology

The purpose of this pre-launch validation study was to investigate and further substantiate that Virto B-Titanium hearing aids are more invisible than previous Phonak acrylic products with the same power level (i.e. the Virto V-nano and Virto V-10 NW 0). In pre-validation analysis, a modeling expert created the smallest possible Virto V-nano, i.e. anatomy aside, the smallest amount of internal space which was required to fit all of the mandatory nano components. Then they did the same modeling procedure for the Virto B-Titanium. Both Virto V-nano and Virto B-Titanium were M receiver devices. The results showed a 26% decrease in overall device volume. Additionally, an internal fit rate study looked at 20 ear impression scans. Ear impression scans are used regularly for fit-rate studies due to their fair reflection of general anatomical characteristics. This fit rate study showed an improvement in the IIC fit rate by 64% compared to the Virto V-nano and a 60% IIC fit rate for SP receiver Virto B-Titaniums.[2] The following three month investigation was conducted at Phonak Headquarters in Stäfa, Switzerland to determine if this theorhetical decrease in hearing aid size would be visible in human ears.

The study included two different assessments of visibility utilizing a new methodology on adult subjects with mild to moderate hearing loss. The first visibility assessments were made by hearing care professionals (HCPs), and the second visibility assessments were made by new or existing hearing aid users.

Part 1: Observation by HCPs

In the first visibility assessment, subjects were seated individually on a stationary chair (see figure 2a). A tripod was fixed to the chair and was able to be rotated 180°around the chair. An HCP was instructed to align their

nose with the top of the tripod and walk slowly around the subject taking the tripod with them and keeping their nose in the same place. They walked first from 0° and then again from 180°: i.e. starting from the front and then the back.

Figure 2a. The subject was seated on a chair while an HCP moved a tripod around the subject and stopped when the hearing aid was visible to them.

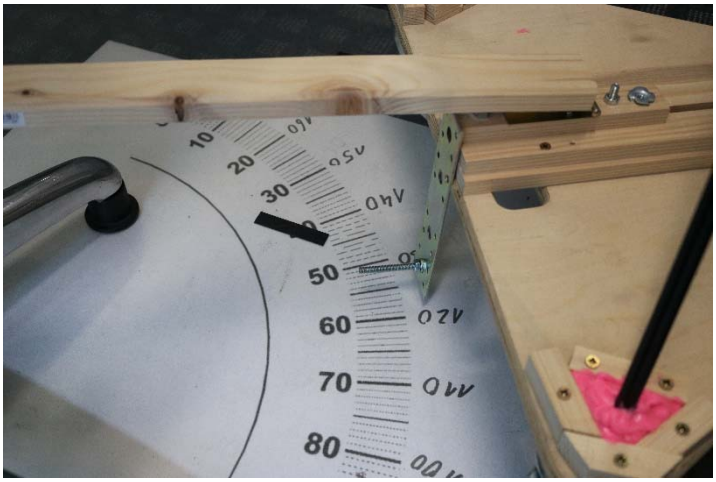

Figure 2b. A metal marker reveled the angle at which the hearing aid became visible to the HCP.

As the HCP walked around the platform, they stopped moving the tripod when any part of the hearing aid first became visible (if it was visible at all). They were instructed to ignore the presence of the removal handle. A metal marker fixed to the tripod revealed the angle at which the hearing aid had first become visible (figure 2b and figure 3).

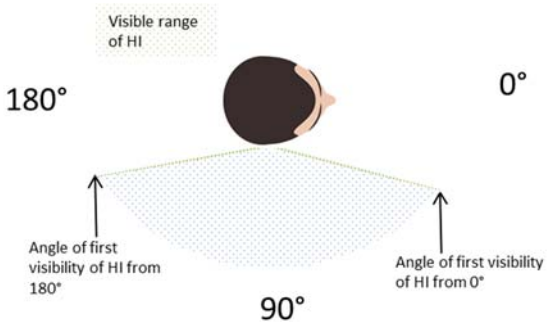

Figure 3. Diagram of set up for HCP observation.

Observations were made in 6 test conditions for 26 subjects, to compare the device sizes with new optional configurations: more venting or more power (see figure 4). The Virto V-nano was available with only an M receiver, however the Virto B-Titanium can fit M, P, and SP receivers. Due to size differences between receivers, this configuration was included to determine if more power could be acquired without substantial size consequences. Another configuration option tested was a larger vent. Acoustically Optimized Vent-Open, (AOV-O) is a new iteration of the long-standing venting algorithm AOV. It is based on the same formula, but with modified criteria, to create a more open fitting for clients who prioritize comfort. As larger vents also take up more space, this configuration was included to determine if a bigger vent could be acquired without substantial sizing consequences.

Virto B-Titanium configuration	versus	Comparable device on previous platform
Virto B-Titanium (M receiver, AOV) Virto B-Titanium (M receiver, AOV-O)	vs.	Virto V-nano (M receiver, AOV)
Virto B-Titanium (P receiver , AOV) Virto B-Titanium (P receiver, AOV-O)	vs.	Virto V-10 NW O (P receiver, AOV)

Figure 4. Six configurations tested during the HCP observation.

Part 2: Observation by new/existing hearing aid users

The second visibility assessments were made by either new or existing hearing aid users. In this condition, four individuals wearing test devices were videotaped while they rotated 360° on the observation platform. Impartial observers watched this footage and indicated when they first saw any physical part of the device by stopping the video. All observers were instructed that the ears may or may not be fitted with a device, and not to base visualization on the presence of the removal handle. To generate the least biased

responses, observers were also told that some ears contained only removal handles and no devices. In cases where the device was not visible, the observers were instructed to not stop the video. In this assessment, up to four conditions were tested (see figure 5).

Virto B-Titanium configuration	versus	Comparable device on previous platform	Number of subjects
Virto B-Titanium (M receiver, AOV)	vs.	Virto V-nano (M receiver, AOV)	4
Virto B-Titanium SP receiver, AOV)	vs.	Virto V NW 0 (SP receiver, AOV)	2

Figure 5. Four configuration options tested during new/existing hearing aid user observation.

Results

Part 1: Results from HCP observation

The results of the first visibility assessments made by HCPs were quantified by two different metrics: Visibility Radius (VR) and an Invisibility Score (IVS). The VR was calculated based on the total range where any part of the device was visible by combining the observation from the front (0°) and the back (180°). The IVS was calculated based on the percent of the time the observer reported they didn't see a device in the ear, i.e. it was completely invisible (see figure 6).

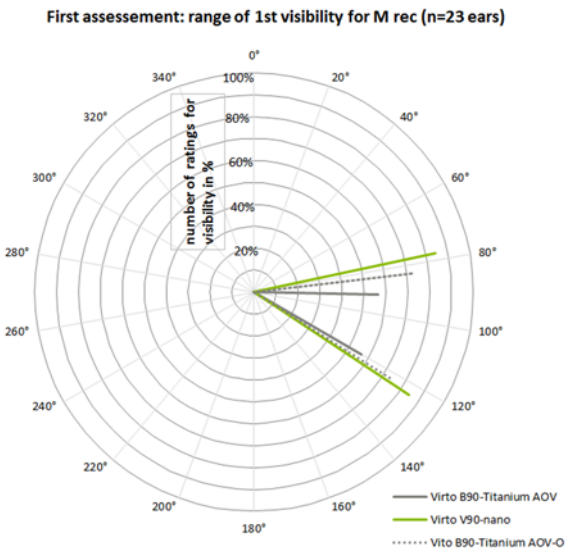

Figure 6. Results from the first visibility assessments made by the HCPs, M receiver configurations with averages for the VR and IVS score. The VR is visualized by the surface area between the front and back observations, and the IVS is represented by the length of the lines.

The outcome of the visibility assessment by HCPs showed that all Virto B-Titanium configurations, regardless of venting and power level, had on average a more favorable (narrower) VR. For M receiver configurations, the Virto B-Titanium was nearly 3 times more likely to be completely invisible (see figure 7). Virto V-nano was on average completely invisible for 15% of ears while the comparable Virto B-Titanium was on average completely invisible in 43% of ears: 3 times less visible.

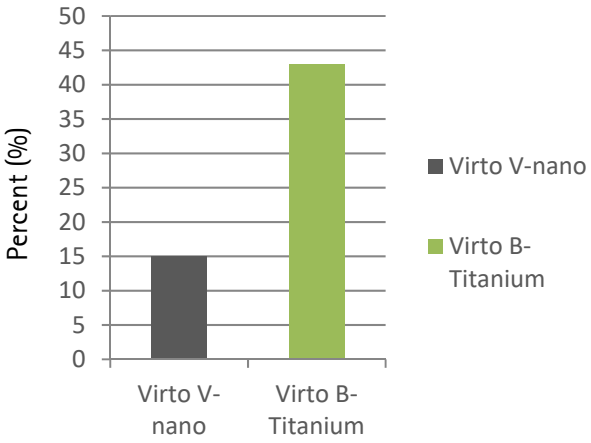

Figure 7. Invisibility Score (IVS) in percent for M receiver devices, from HCP observation. Number reflects the % of the time the device was completely invisible.

When evaluating visibility from the back, the degree of first visibility is similar. This can be attributed to the loss of the protective nature of the tragus (the effect of which can be seen during frontal observations).

Part 2: Results from new/existing user observation

The second visibility assessments made by new or existing hearing aid users were also quantified by two different metrics: Visibility Score (VS) and an Invisibility Score (IVS). The VS varies slightly from the VR (from the first assessment made by HCPs) as the observations were made only once during a 360° observation, rather than from the front and then from the back. The VS reflects the average degree at which any part of the device except the removal handle first became visible from frontal target sources (see figure 8).

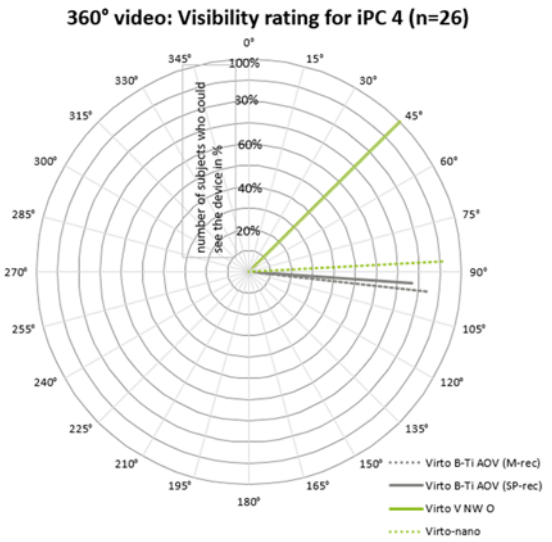

Figure 8. Complete observation averages by new or existing hearing aid users for all 4 configurations for one video-participant. The VS reflects the average degree at which the observers indicated that any part of the device became visible from the 0°. The IVS is reflected in the length of the handle.

The outcome of the visibility assessment by new or existing hearing aid users was that M receiver Virto B-Titanium configuration had a more favorable VS and IVS than the Virto V-nano. P receiver Virto B-Titanium devices achieved either the same visibility of an M receiver Virto V-nano or better. The Virto V NW O with a SP receiver was visible at 45° and the SP receiver Virto B-Titanium was not visible until 93°, same power as before but 2x less visible (see figure 9).

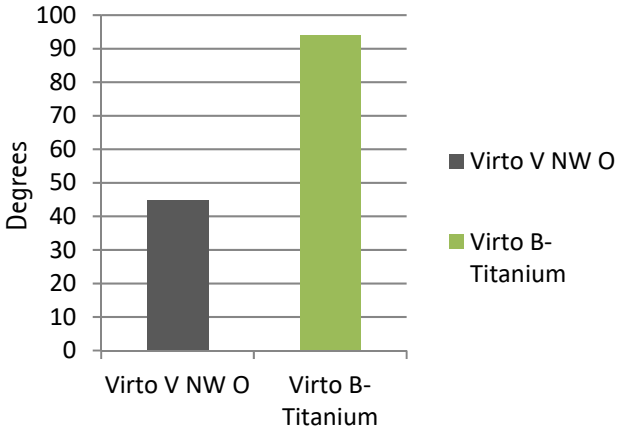

Figure 9. Visibility Score (VS) in degrees for SP receiver devices from new or existing user observations.

Conclusion

On average, hearing care professionals and new and existing hearing aid users perceived the Virto B-Titanium to be less visible in the ear than the comparable Virto V device. However the biggest size benefits are for users who have the need for more power than a Virto V-nano has to offer. Clients who have been asking for IICs for years but were unable to benefit from them because they were not powerful enough or did not meet their needs for comfort can now wear a discreet Virto B-Titanium. Small is a big topic when it comes to hearing aids: thanks to the thin titanium shell, the Virto B-Titanium is the smallest Phonak custom product ever!

References

1. Sonova (Jan 2016) B2C Consumer Segmentation #668 N1229, GER, USA, CHN, FRA
Sonova (Jan 2016) B2C Consumer Segmentation #668 N1277, GER, USA, CHN, FRA
2. Bishop, R. (2017). Technical Report: Virto B-Titanium fit rate study.

Investigator

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Timo undertook an apprenticeship as a Hearing Care Professional from 2005 to 2008. From 2008, he studied Hearing Technology and Audiology at the Jade University in Oldenburg, completing his Bachelor of Engineering in 2011. He has worked for Phonak AG since 2011. He started in the Science and Technology department as a research audiologist and joined the validation team in 2014 as Validation Manager.

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