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Craftsmanship and Consistency in Custom Hearing Aids

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ABSTRACT

In 2018, Oticon will release a new range of Opn Custom hearing aids. In order to secure and preserve the high quality of Oticon Opn devices, significant time and effort has been put into developing consistently discreet, high quality hearing aids.

Focusing on cosmetics and consistency and based on the existing Oticon Invisible-In-the-Canal (IIC), it was determined that a Key Performance Indicator (KPI) related to discreetness should be established.

Today, Oticon can confidently claim that eight out of ten people who wear hearing aids will receive an invisible device when an Oticon Opn IIC instrument is ordered.

What does it take to be invisible?

An invisible hearing aid has been defined as a device that cannot be seen when viewed at a 90 degree angle. In other words, other people should not be able to see the device when correctly placed in the ear. With this definition in place it is now possible to measure an invisibility rate on a global scale in production.

Introduction to Craftsmanship Initiative

Whilst it seems obvious that an IIC needs to be invisible, these instruments can be difficult to produce with a consistency in invisibility quality. When looking at the nature of custom hearing aids, they are just that: customised for every person wearing the hearing aid. Since every ear is different, production technicians need to be able to access specialist tools and to have high level skills to ensure that quality products are made.

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In early 2016, the Oticon Alta 2 Pro IIC was introduced and production was undertaken on a local scale. Back then, it was found that large variances existed across sites in terms of build size, and a global focus would lead to consistency in production across all sites. With this in mind, the Craftsmanship Initiative (CMS) was initiated in late 2016. Primarily charged with developing an IIC that was to be consistently as small as possible, the initiative also focused on ensuring consistency across worksites and production lines. As a consequence to the CMS, Oticon adopted a global strategy in 2017 that focused on reducing the size of the produced Oticon Alta 2 Pro IIC's devices sustainably. This strategy infers Oticon to produce consistently small and reliable custom hearing instruments in time for the 2018 Oticon Opn launch.

Overall, the CMS can be broken into two sections. Firstly, smaller materials were developed in order to reduce the overall hearing instrument size. Secondly, the CMS focused upon improving the skills of those on the assembly line who were in charge with building the instruments via an extended training. Build methods were also modified. Overall, the focus was on improving quality to such an extent that the instruments produced could fulfil the wishes of both the hearing care professional and the people wearing the hearing aid who demand discreet hearing instruments.

Reduction in size

In order to achieve the smallest instrument possible, new smaller components were developed. In 2016, a smaller microphone was introduced. Following this, further size reducing refinements were initiated. A new faceplate was developed in order to house a shorter battery door pin so that the instruments fit further into the ear canal. Programming pins were also removed. New printers have been utilised in order to produce a shell which allow a reduced thickness locally from 0.6mm to 0.4mm. Additionally, a smaller amplifier has been implemented. All of these changes have contributed to a significant size reduction of the Oticon Opn IIC (see figure 1). Figure 2 shows the mentioned progression over time.

What was trained?

Modelling

Training was broken down into specialisations. To provide more space for components inside the hearing aid, the modellers were taught to expand the shell in the sealing zone from 0.4mm to 0.6mm. Additionally, they were trained to reduce the shell thickness locally, meaning the modeller evaluates which selected areas of the shell can be reduced. As a result, internal space is gained without compromising shell reliability. Subsequent training focused on component placement, which optimized the internal space of the shell and contributed to building smaller instruments.

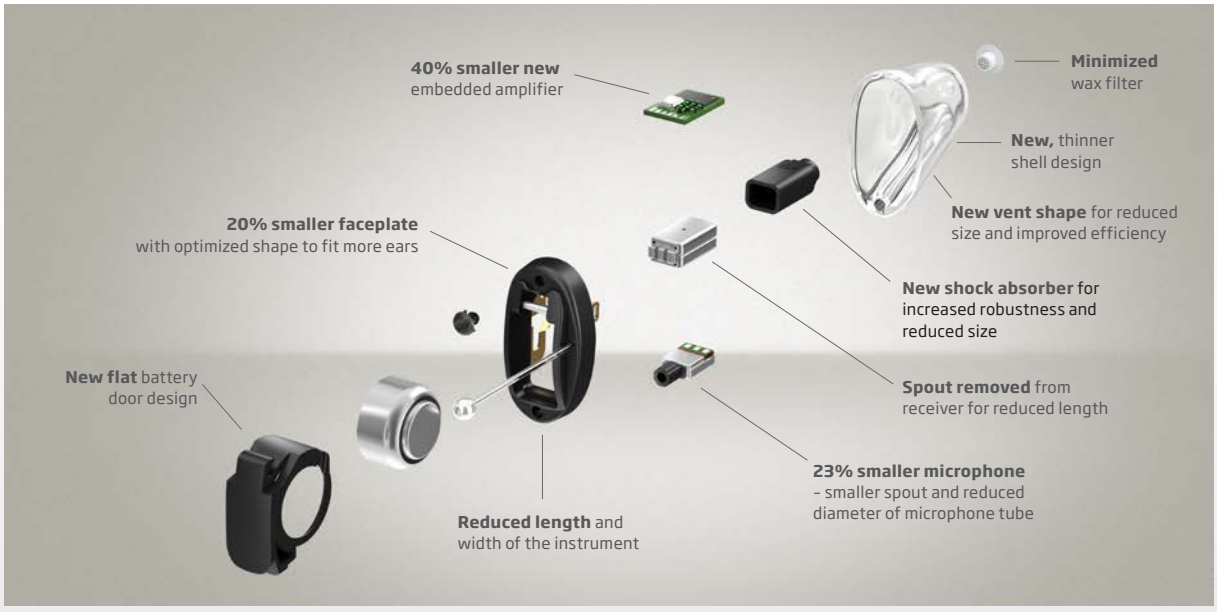

Figure 1. An overview of the components in the IIC and the achieved improvements.

As invisibility was a major focus area, the modellers also learned how to measure the hearing aid invisibility.

Assembly
The assembly specialists trained extensively on new techniques. These included placing the componentry, utilising the modelling preview, and preparing the shell before closing it with the faceplate. These steps all contribute to ensuring the instruments are as cosmetically small as possible.

Quality Control
The quality specialists focused on implementing additional reliability checks throughout the process.

Outcomes

With this large focus and investment in both training, advanced equipment, and optimized processes, it was important that the results regarding build rates, invisibility rates, and total production data, were measured globally in a systematic and comparable way in order to get reliable outcomes. Thus, these results have been measured weekly from each site.

In order to apply this knowledge to the 2018 Oticon Opn IIC launch, it was reasoned that the Oticon Alta 2 Pro 75 speaker without Near Field Magnetic Induction (NFMI/NearLink) would serve as a baseline measure. Although much of the componentry is smaller in the Oticon Opn IIC compared to the previous IIC's (the microphone is 23% smaller than in the Oticon Alta 2 Pro and the embedded amplifier is 40% smaller than previous generations of Inium Sense instruments), the skills needed to build the two generations of Oticon IICs are the same. From mid-2017, each production site has logged the appropriate data on a weekly basis. By monitoring in such short time intervals, issues can be identified early and steps can be enacted to address problem areas immediately.

How is Invisibilty measured?
Invisibility in the production is measured in the 3D modelling preview. The digital impression with 3D modelling is placed at a 90 degrees angle, and then technician assesses if the battery drawer is visible or not. Based on this observation, the technician marks the order in the Navision Enterprise Resource Planning (ERP) system, which is a system that streamlines processes and information across the entire organization.

The data are collected from ERP systems and verified in accordance to:

- Possible gaps
- Wrong measurement
- Measurement verification

With this information combined, the Oticon Opn IIC can be assessed for invisibility in the ear.

What does this mean?

Now that Oticon has adopted a global approach to production, global and local invisibility rates can be measured in a given time frame and thus provide near real-time information. With this in place, we can con-

Progression over time

Figure 2: Progression of the Oticon IIC over time

fidently and accurately claim that **eight out of ten people who wear hearing aids can have an invisible hearing aid.**

When looking at the global invisibility rates from January to May 2018, a consistent improvement in the invisibility ratio can be noted on a global scale (see figure 3).

What you need to know

The global measure is taken from an aggregate of the monthly builds from seven of the production facilities (Poland, USA, Japan, Australia, Canada, Korea, and China). The pieces measured are from the 16.2 Oticon Alta 2 Pro IIC family with 75 speaker and without NFMI.

Conclusion

Through innovation and development, Oticon has been able to provide the people who wear hearing aids with a **truly invisible** Oticon Opn device. Through new design, extended training, and continuous monitoring and improvement, Oticon is now consistently producing the smallest hearing aid we have ever launched on a global level.

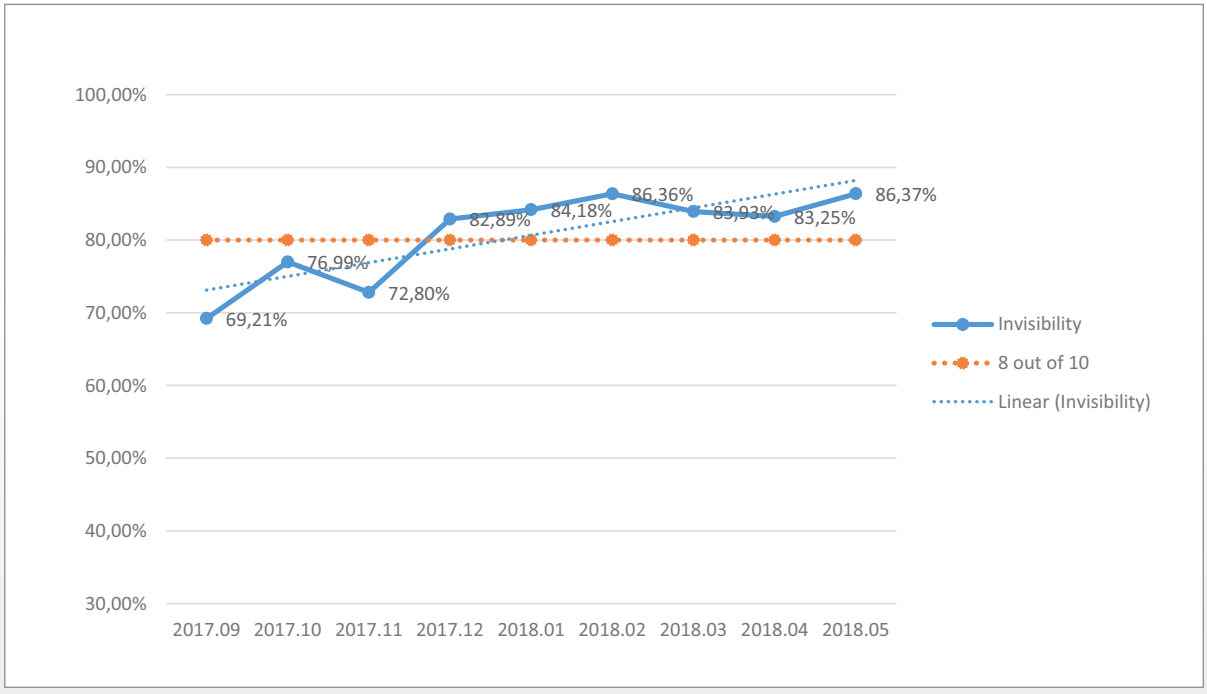

Figure 3: Global Invisibility Rates

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