Hearing the Call for Rapid Prototyping

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The manufacture of hearing aids has traditionally involved a time-consuming, manual process that limited the amount of production that could be achieved by a single technician. However, with the implementation of rapid prototyping technology alongside CAD/CAM solutions, this process has been sped up exponentially. This article looks at the changing trend for the production of hearing aids.

A hearing aid is an electroacoustic device that typically fits in or behind the wearer's ear, and is designed to amplify and modulate sound for the wearer. Earlier devices, known as “Ear Trumpets,” were passive, funnel-like amplification cones designed to gather sound energy and direct it into the ear canal.

There are many types of hearing aids, which vary in size, power, and options. The different sizes and models include body worn aids, behind the ear aids (BTE), receiver in the canal/ear (CRT/RIC/RITE), earmolds, in the ear aids (ITE), and invisible in canal hearing aids (IIC).

A decade ago, Objet’s [1] rapid prototyping machines formed the market standards for mass customization of hearing instruments. Within a few years, Objet’s technology transformed the market from a manual process to complete digital rapid prototyping production. Today, many of the world's hearing aids, custom noise protection, and custom monitors are produced using rapid prototyping. Since flexibility should be high on each hearing aids production lab’s list when choosing a new digital production system, rapid prototyping is an excellent choice as it allows for a wide range of configuration options and can often plug and play into an existing lab environment.

Business surged for laboratories that implemented a full digital workflow for their ear mold production process. By coupling CAD/CAM solutions with rapid prototyping machines, hearing aids labs immediately gained new key benefits, such as

consistent quality, perfect fit, reduced production time, and minimal production costs.

A growing number of customers are seeking customized hearing instruments. Keeping pace in this rapidly swelling market is a losing battle using traditional manual production methods. As large orders continue to pour in, hearing aids laboratories have realized they must move from single-object to batch-production processes.

Traditional methods, involving plaster and gel forms, are error-prone and require extra inspection and adjustment after manufacturing. Additionally, products are too often returned for remake because customers are not satisfied with the fitting and comfort. Though ear mold duplication was an essential part of the traditional hearing aid business, the process was unacceptably time-consuming. It required that impressions and molds were labeled and stored, with the accuracy of replicas meticulously controlled.

Hearing Aid Manufacturer's Key Selection Criteria

- Enable mass customization and batch production
- High quality rapid prototyping
- 3D scanning of ear impressions—dual and single impressions
- Seamless workflow from scan—CAD-design to manufacturing
- Compatibility between systems components

Other factors led hearing aids laboratories to feel they were lagging behind. For example, many orders included requests for customized power vents incorporated into the ear molds—service hearing aids labs could not provide with accuracy in an efficient timeframe.

Hearing aids labs realized that the answer to their key concerns and workflow issues lay in a CAD/CAM solution. Many also recognized that a fully digital, in-house production system could offer even greater benefits.

Hearing aids labs utilize 3D scanning of ear impressions, CAD-design of models and CAM preparation, and a rapid prototyping machine for the manufacturing stage. A rapid prototyping machine's high speed, fine detail, accuracy, layer thickness, and smooth surface output make it ideal for the high volume manufacture of hearing instruments. Furthermore, the steps for preparation and starting of the manufacture process on a rapid prototyping machine are easily integrated within hearing aid software systems, so the full solution's two components can integrate seamlessly.

With in-house ear impression scanning and user-friendly CAD tools, hearing aid lab

technicians can turn a traditional ear impression labor production into a digital manufacture-ready model in just two minutes. Technicians can prepare and trigger batch-manufacturing of 100 orders on a rapid prototyping machine while moving on to the next case-orders. The technician's job is made easier while daily production yield skyrockets.

Going digital enables hearing aid labs to increase the quality and precision of their products, greatly reducing the number of redo orders. Armed with intuitive tools in design software, labs can effortlessly detect and remove defects from the digital model, thereby ensuring a perfect fit for each customer.

The new technology also allows hearing aid labs to become modern solution providers. Their designs can now include customized sound bores, vents, and smart placement of electronics. With digital storage and order management, remake orders become a simple matter of loading the saved design on the system and sending it to a rapid prototyping machine for fast, high quality manufacturing. With the use of rapid prototyping, a hearing aid lab's investment is returned exponentially through increased business, batch processing, rationalized production, and reduced operation costs.

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