

Hearing aid ear plug with an extraction cord

The present invention relates to hearing aids and to methods of making hearing aids. The invention more specifically concerns an ear plug for a hearing aid, which ear plug
5 is made of a resilient material and is provided with an extraction cord for pulling the ear plug out of an ear canal. The invention further relates to a method for manufacturing the ear plug

One general class of hearing aids comprises the behind-the-ear type with a housing
10 placed behind the ear and an ear mould or ear plug arranged in the ear canal of the hearing aid user. The sound signal is picked up, amplified and processed in the behind-the-ear unit suitably to compensate the user's hearing deficiency, and transferred to the ear plug as an acoustic signal through a sound tube or as an electrical signal through a wire to a receiver or loudspeaker arranged in the ear mould.

15 For many hearing aid users a soft, pliable and resilient ear mould will be preferred as this will more easily adapt to the shape of the auditory canal wall, and thereby be more comfortable to the hearing aid user. Furthermore, a soft and resilient outer surface will make continuous adaptation to changes in the geometry of the ear canal feasible. Such
20 changes in geometry may be caused e.g. when the hearing aid user is chewing or yawning.

If the resilient ear plug is also custom fitted to the individual shape of the auditory canal this will be the optimum solution as this will minimize any localized mechanical
25 pressure in the auditory canal. The custom fitted resilient ear plug may be manufactured according to the method described in PCT/EP2008/063663.

In order to be able to remove such earplugs from the ear canal an extraction cord is often provided. An extraction cord projects out of the ear plug, and just outside, or
30 close to the outside, of the ear canal, such that the person wearing the hearing aid can grab the extraction cord between two fingers and pull out the earplug from the ear canal.

WO-A1-98/51125 discloses an ear mould for a hearing aid, where the ear mould is made of a soft and pliable material such as silicone. The ear mould is provided with fins for obtaining a comfortable fit to the ear canal and for holding the ear mould in the ear by both friction and by mechanical latching. The ear mould is further provided with an extraction cord for pulling out the ear mould.

The problem with the known solutions of soft and pliable ear plugs or ear molds provided with extraction cords is, that it is difficult to make a sufficiently strong construction where the extraction cord will not either break off, or be drawn out of the soft and pliable material.

This problem has been solved by the invention according to a first aspect as described in claim 1. According to the first aspect, there is provided an ear plug for a hearing aid, said ear plug being made of a resilient material and provided with an extraction cord for providing a grip by which a user can pull the ear plug out of an ear canal, said extraction cord being arranged partly in the resilient material and partly outside the ear plug, wherein a securing bulge is arranged on the part of the extraction cord arranged in the resilient material, in order to secure the position of the extraction cord in the resilient material, wherein the extraction cord is bonded to the resilient material and wherein said securing bulge is provided with either a first color marking for indicating that the ear plug is to be used in the right ear or with a second color marking for indicating that the ear plug is to be used in the left ear.

Also disclosed is an ear plug for a hearing aid where the extraction cord has been arranged partly in the resilient material and partly outside the ear plug, and wherein a securing bulge is arranged on the part of the extraction cord arranged in the resilient material, in order to secure the position of the extraction cord in the resilient material, and wherein the extraction cord is bonded to the resilient material.

This solution has the advantage of providing the ear plug with an extraction cord which is very strong and is not easily drawn out of the resilient material. The bonding may be achieved either by a suitable glue, or by hardening the resilient material after placing and holding the extraction cord in the correct position whereby the resilient material will bond to the extraction cord.

In a further embodiment the extraction cord is provided with holding means in order to avoid the fingers slipping when pulling the extraction cord. This makes it easier to get a good grip by the fingers on the extraction cord, and the length of the extraction cord can at the same time be kept at a minimum. Preferably, the holding means are droplet shaped or substantially droplet shaped and arranged at the end of said extraction cord. Such a shape will be easy to manufacture and avoids any edges which could bother the skin.

In a further embodiment the securing bulge is cone shaped or substantially cone shaped with the axis of the cone being parallel or substantially parallel with the length direction of the extraction cord, and wherein the part of the cone having the largest cross sectional area is facing the end of the extraction cord extending out of the resilient material. This is also the pulling direction or the direction out of the ear. This shape has been found to be the optimal shape both for entering the extraction cord through a narrow hole and for avoiding the extraction cord being pulled out of the resilient ear plug material.

In a further embodiment the securing bulge is provided with either a first color marking for indicating that the ear plug is to be used in the right ear, or with a second color marking for indicating that the ear mould is to be used in the left ear. This is a simple and durable way of marking the ear plug, and making them easily discernable to the hearing aid user. Preferably, the resilient material is at least partially transparent in order for the color to be visible when the ear plug is not in the ear canal.

In a further embodiment the extraction cord has a total length of 15 – 25 mm, preferably 18 – 22 mm. This range has been found to be suitable for easily getting a grip with the fingers in the extraction cord without the extraction cord being more visible than necessary.

In a second aspect the invention is related to a method of manufacturing a resilient ear plug with an extraction cord comprising the steps of providing a material for a resilient ear mould, forming a resilient ear plug from said material, providing an extraction cord having a length direction and a cross sectional area, said extraction cord being provided with a bulge on part of its length having a cross sectional area larger than the cross sectional area of the remaining part of the extraction cord, said bulge is provided with either a first color marking for indicating that the ear plug is to be used in the right ear or with a second color marking for indicating that the ear plug is to be used in the left ear, entering said extraction cord partly into the resilient ear mould material with the bulge on the part of the extraction cord entered into the material, and with an end of the extraction cord extending outside the ear plug material, bonding said extraction cord to the resilient ear mould material.

Also disclosed is a method of manufacturing a resilient ear plug with an extraction cord comprising the steps of providing a material for a resilient ear mould, forming a resilient ear plug from said material, and providing an extraction cord having a length direction and a cross sectional area, said extraction cord being provided with a bulge on part of its length having a cross sectional area larger than the cross sectional area of the remaining part of the extraction cord. The method comprises the step of entering said extraction cord partly into the resilient ear mould material with the bulge being on the part of the extraction cord entered into the material, and with an end of the extraction cord outside the ear plug material. The method further comprises the step of bonding said extraction cord to the resilient ear mould material.

By this method an ear plug with a mechanical strong extraction cord is manufactured.

In a further embodiment the method comprises the step of providing a hole in said
5 resilient material for said extraction cord, before entering the extraction cord into said
resilient material. Preferably, the extraction cord is then bonded by adding a suitable
glue. Such glue is preferably entered in the hole before the extraction cord, or applied
directly to the extraction cord. In an alternative embodiment of the method the
10 extraction cord is entered into the resilient ear mould material before this material is
hardened. Preferably, the extraction cord is then bonded by the hardening of the ear
mould material.

In a further embodiment of the method the extraction cord including the bulge is
manufactured by injection molding. This facilitates a fast and accurate manufacturing.

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Embodiments of the invention will now be explained in further detail with reference to
the figures.

Figure 1 illustrates an ear plug with an extraction cord.

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Figure 1 show an embodiment of an ear plug 1 with an extraction cord 4, where the ear
plug part 2 has been custom fitted to a specific ear canal. The ear plug 2 has been made
in a soft, pliable and resilient material, such as a silicone. The ear plug 2 is provided
with an open space 3 or hole for arranging the receiver or for connecting a sound tube.
25 This space goes through the earplug connecting the end outer surface 8 facing the open
end of the ear canal with the inner surface 9 facing the ear drum when the ear plug is
arranged in the ear canal. A receiver (not shown) may be secured in this space. It is
connected by electrical wires to the behind-the-ear housing part of the hearing aid.
When the hearing aid is of the type having the receiver in the behind the ear part, the
30 sound is guided to the ear plug through a sound tube which ends in the space 3 and is
secured to the ear plug 1.

An extraction cord 4 is important in order to avoid that the hearing aid user pulls out the ear plug by drawing in the electrical wire or in the sound tube. If this is done repeatedly this may lead to failure of these components.

- 5 The extraction cord 4 comprises the cord part or shaft part 7, holding means in the form of a knob 5 and a bulge part in the form of a barb or a cone shaped bulge part 6. The bulge part 6 has to be arranged inside the ear plug material, when the extraction cord is placed at a point 10 in the ear plug material. The bulge part could have other shapes than cone shaped. The important thing is that it is easy to insert the extraction cord into
- 10 a hole in the ear plug material, and that the bulge part, by its shape and by bonding or gluing, resists being drawn out of the ear plug material. The cord part 7 could be provided with more than one bulge part, e.g. two cones instead of one. However, there is usually not much space in the ear plug material, and therefore the volume of the extraction cord should also be kept at a minimum in order not to reduce the stability or
- 15 strength of the ear plug material.

In an example of the extraction cord it is made of polyamide or nylon, and the shaft or cord part 7 has a diameter of about 0.5 mm and a length of about 16 mm. The total length of the extraction cord is about 20 mm, where the knob 5 has a diameter of about

20 2 mm and the cone 6 has a length along a longitudinal axis of the cord of about 2 mm. The maximum diameter of the cone is about 2 mm. In practice the extraction cord will be manufactured in different lengths in order to fit into different sizes of ear plugs.

The extraction cord may be moulded in one step with the three parts mentioned

25 included. Alternatively the cord part 7 and the knob 5 are made in a first step, and the cone 6 is made in a second step, and subsequently attached to the cord part 7, e.g. by gluing. This makes it simpler to manufacture the cone in a different colour, and even in a different material. The colour of the cone 6 will usually be visible through the more or less transparent material of the ear plug part 2. The cord part 7 and the knob 5 of the

30 extraction cord 4 will usually also be made transparent in order to make the ear plug as such less visible. If the cone 6 in each of two ear plugs for the same person is made in different colours, e.g. red for the cone in the right ear plug and blue for the cone in the

left ear plug, it will be much easier for the person to remember which ear plug has to be placed in which ear.

5 The advantage of colouring the cones is, that the colouring is more durable than would be the case with colouring of a silicone surface, that the colouring of the cone is not subject to wear and that the logistics are simpler by relying on a standard, non-customized component for colour indication.

10 The resilient material of the ear plug is preferably silicone. A preferred silicone is the Biopor, which is biocompatible. However, other resilient materials, such as soft acrylic may also be applied. The ear plug is usually cast in a mould formed on the basis of data representing the shape and size of the ear canal of the person going to use the hearing aid. Depending on the type of silicone applied, different methods may be used for hardening the silicone. Examples of methods for hardening are heat, ultraviolet
15 radiation and mixing of a two-component silicone. The resilient material should preferably be bio-compatible. A resilient material is understood as being a material resuming its original shape after compression

20 The extraction cord is preferably manufactured by injection moulding but other manufacturing methods as might be suggested by those skilled in the art may be applied as well.

The extraction cord 4 can be placed in the ear plug material in different ways. In one way the resilient ear plug material is hardened first, and a hole for the extraction cord is
25 made, e.g. by drilling. The diameter of this hole will be slightly larger than the diameter of the shaft or cord part 7, but smaller than the largest diameter of the cone 6. This will make the extraction cord easy to enter into the material, leave sufficient space for the glue, and make the extraction cord difficult to draw out.

30 Another way to arrange the extraction cord in the ear plug material is to arrange it in the material before this is hardened. In that case gluing will not be necessary, because the material will bond to the extraction cord while hardening.

Claims

1. An ear plug for a hearing aid, said ear plug being made of a resilient material and provided with an extraction cord for providing a grip by which a user can pull the ear plug out of an ear canal, said extraction cord being arranged partly
5 in the resilient material and partly outside the ear plug, wherein a securing bulge is arranged on the part of the extraction cord arranged in the resilient material, in order to secure the position of the extraction cord in the resilient material, wherein the extraction cord is bonded to the resilient material and wherein said securing bulge is provided with either a first color marking for indicating that
10 the ear plug is to be used in the right ear or with a second color marking for indicating that the ear plug is to be used in the left ear.
2. An ear plug according to claim 1, wherein said extraction cord is provided with holding means for providing a grip for the fingers for pulling the extraction cord
15 to pull out the ear plug.
3. An ear plug according to claim 2, wherein said holding means are droplet shaped or substantially droplet shaped and arranged at the end of said extraction cord.
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4. An ear plug according to any one of the preceding claims, wherein said securing bulge is cone shaped or substantially cone shaped with the axis of the cone being parallel or substantially parallel with the length direction of the extraction cord, and wherein the part of the cone having the largest cross sectional area is
25 facing the end of the extraction cord extending out of the resilient material.
5. An ear plug according to any one of the preceding claims, wherein the resilient material is at least partially transparent.
- 30 6. A method of manufacturing a resilient ear plug with an extraction cord comprising the steps of

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 - providing a material for a resilient ear mould,
 - forming a resilient ear plug from said material,
 - providing an extraction cord having a length direction and a cross sectional area, said extraction cord being provided with a bulge on part of its length having a cross sectional area larger than the cross sectional area of the remaining part of the extraction cord, said bulge is provided with either a first color marking for indicating that the ear plug is to be used in the right ear or with a second color marking for indicating that the ear plug is to be used in the left ear,
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 - entering said extraction cord partly into the resilient ear mould material with the bulge on the part of the extraction cord entered into the material, and with an end of the extraction cord extending outside the ear plug material,
 - bonding said extraction cord to the resilient ear mould material.
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- 7. A method according to claim 6, further comprising the step of providing a hole in said resilient material for said extraction cord, before entering the extraction cord into said resilient material.
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- 8. A method according to claim 6 or 7, wherein said extraction cord is bonded by adding a suitable glue.
- 9. A method according to claim 6, wherein said extraction cord is entered into the resilient ear mould material before this material is hardened.
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- 10. A method according to claim 9, wherein said extraction cord is bonded by the hardening of the ear mould material.
- 11. A method according to any one of the claims 6 – 10, wherein said extraction cord including the extension is manufactured by injection molding.
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