METHOD OF MAKING CUSTOM-FITTED EARPLUGS FOR HEARING AIDS

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3 Claims

ABSTRACT OF THE DISCLOSURE

A method is disclosed for forming in situ a resilient custom-fitted earplug for a hearing aid. The earplug has a continuous auditory path through its center which is formed by inserting a flexible tube into the ear canal before a curable material is injected into the ear canal. A removable plug can be attached to the flexible tube as a means for centering that tube in the ear canal, and a reinforcing member can be inserted into that tube to center and to prevent it from collapsing when the curable material is injected around it.

This invention relates to the manufacture of custom-fitted earplugs for supporting the receiver of a conventional hearing aid in the ear and more particularly to improved methods of forming such devices.

It is now a common practice in the hearing aid art to provide plugs that fit into the ear of the wearer to provide a more efficient auditory connection between the amplifier and the inner ear. Earlier devices of this type utilized receiver-holding ear plugs of substantially uniform shape to conform to the ear of the average wearer. These plugs, in general, were ill fitting and generally unsatisfactory.

The next step in the art was the obvious one of attempting to custom fit the earplugs to the ear of the individual to whom the hearing aid was being fitted. Earlier devices of this sort where made by forming a negative cast of the ear canal and molding a plug from the negative cast. This method, however, while forming reasonably well-fitted plugs, was time consuming and required a high degree of skill.

A still further step forward in the art was the provision of curable resins which, in effect, made the negative cast useful as a plug. The plug could be drilled to provide the necessary auditory connection through the plug. One disadvantage of the resinous materials was the fact that some heat was usually generated by the material as it cured. The heat was quite often uncomfortable to the patient.

A further problem was the fact that the resins were hard and, in general, were uncomfortable when worn in place in the ear. Due to curvatures sometimes encountered in the ear canal, the rigid materials were also difficult to insert and remove and problems in drilling an auditory path through the plug were encountered.

There is described in U.S. Patent No. 2,910,980 an ear protector formed in situ from a room-temperature curing silicone rubber composition. This device was aimed at protecting the ear from irritating noises and in general, to act as an acoustic guard. The ear protector was flexible and, therefore, could be easily inserted into the ear and removed. The silicone rubber material, however, was difficult to bore through to provide a satisfactory auditory passage.

It is a primary object of the present invention to provide a method of making custom-fitted earplugs for hearing aids which eliminates the problem set forth hereinabove.

A further object is to provide a resilient earplug which has a continuous auditory path therethrough.

In accordance with these and other objects there is provided by the present invention a novel method for making a custom-fitted earplug for a hearing aid which is similar in many respects to the ear protector described in the aforementioned U.S. Patent No. 2,910,980, but which has a smooth tube through the center thereof to form an open auditory passage through the plug.

Other objects and attendant advantages of the present invention will become obvious to those skilled in the art from a consideration of the following detailed description when read in conjunction with the accompanying drawings wherein:

FIG. 1 is a cross-sectional view illustrating the method of forming the earplug of the present invention.

FIG. 2 is a cross-sectional view similar to FIG. 1 showing the complete earplug in place in the ear canal.

Referring now to the drawings wherein like reference characters represent like parts in both figures, there is shown in FIG. 1 a fragmentary view of a person's head 11 and showing the ear canal 12 and tympanic membrane or ear drum 13. Since the tympanic membrane 13 is a very sensitive and easily damaged organ, the first step in the process of forming a hearing aid plug in accordance with the present invention is inserting into the ear canal a body 14 of protective material such as cotton or other fibrous material. There is next inserted into the ear canal a length of tubing 15, which in actual embodiment of the invention was a silicone rubber tube having a 0.037 inch internal diameter. If desired, the tubing 15 may be of other suitable plastic or elastomeric materials.

Inserted into the end of the tube 15, which is inserted into the ear canal, there is preferably placed a small plug 16, also of silicone rubber, polyurethane foam, or the like, and which has a circular flange corresponding in diameter to the approximate diameter of the ear canal. If desired, the body 14 of protective material can be glued or sewed to the inner end of the tubing prior to insertion.

A semi-rigid reinforcing member 17 which may, for example, be a length of metallic material such as solder is inserted into the flexible tube 15 until it is in contact with the plug 16. The flange on the plug 16 acts as a centering device for the tube in the ear and the semi-rigid reinforcing member 17 may be bent to conform approximatively to the shape of the ear canal to keep the tube approximately centered therein. The end of the reinforcing member 17 which projects from the tube 15 is preferably extended in the proper direction to fit into the external portion of the hearing aid and a sufficient length of tubing 15 may be provided to reach the auditory connection of a hearing aid worn, for example, on the temple of an eyeglass frame. If a thermoplastic tubing is utilized, the tubing after being bent to the desired shape and reinforced in that shape may be heated and then allowed to cool whereupon the shape will be retained without further reinforcement.

With the fit of the flexible tube adjusted and held in place by use of the reinforcing member 17 a quantity of curable, nonsetting, conformable material is injected around the tube 15 in a quantity sufficient to substantially fill the ear canal as far as the protective material 14; and preferably, a small amount of the material 18 extends against the surface of the outer ear. Depending upon the materials chosen, suitable primers to aid bonding between the tube and the curable material may be utilized. If desired, a receiver ring 19 for connecting the internal hearing aid may be slipped over the tubing and embedded in the curable material 18 at the surface thereof. A preferred material for this use is a room-temperature curing silicone rubber, such as that described, for
example, in U.S. Patent No. 2,927,907 although other similar materials may also be used.

After the curable material 18 has set, the assembly may be removed from the ear. The inner end of the material including the plug 16 is cut off back far enough to expose the open end of the tubing and the reinforcing member 17 is removed from the tubing. The outside surface of the device may be contoured for cosmetic purposes and the inner end of the assembly is preferably rounded off. These operations may be carried out by use of a sharp cutting instrument and/or a small grinder. If the plug is to be used with a hearing aid receiver of the type where no attaching ring is required, no exterior portion need be provided and the entire plug may be inserted into the ear canal.

The resultant device may be simply and without discomfort inserted into and removed from the ear canal. The inner surface of the tube is unbroken and forms a continuous sound track from the amplifier into the ear. Nothing is lost by irregular curves or attaching devices.

If desired, a venting tube may also be provided through the structure in like manner to provide air pressure equalization. A perfect fit is obtained since the plug is custom molded to the ear of the individual with no distortion of the delicate membranes. The close fit besides providing physical comfort to the wearer also aids in preventing feedback.

Obviously, many modifications and variations of the invention will become obvious to those skilled in the art from the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

I claim:

1. A method of forming a custom-fitted earplug for a hearing aid, comprising:
   inserting into the ear canal a body of protective material adapted to prevent damage to the ear drum, providing a length of flexible tubing having an exterior diameter substantially smaller than that of the ear canal,
   inserting a plug having an external portion of a diameter approximately that of the ear canal into one end of said tubing,
   inserting said tubing into the ear canal until said plug is substantially adjacent to said protective material, whereby said plug causes said tubing to be centrally spaced from the inner wall of the ear canal,
   inserting into said tubing a semirigid reinforcing member adapted to prevent the collapse of said tubing and to conform said tubing to the shape of the ear canal to keep said tubing centered therein, injecting into said ear canal a sufficient quantity of curable, nonslumping, conformable material to surround said tubing and substantially fill a portion of the ear canal as far as said protective material, allowing said material to cure, removing the cured material and said protective material from the ear, and
   removing said plug and said reinforcing member from said cured material.

2. A method as defined in claim 1 wherein said flexible tubing is silicone rubber, said reinforcing member is metallic, and said conformable material is a room-temperature curing silicone rubber.

3. A method as defined in claim 1 wherein said flexible tubing is thermoplastic and further including the step of heat-setting said tubing in its desired configuration prior to injecting said conformable material.

References Cited

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