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(54) Title: ELECTRODE INSERTION DEVICE

(57) Abstract: A medical device can be configured for delivering an electrode wire into an inner ear of a subject while retaining the hearing of the subject. Such a medical device can include an elongate member having an electrode wire receiving surface, and a covering member removably coupled to the elongate member so as to form an internal lumen for receiving an electrode wire, wherein the medical device has a cross-sectional profile dimensioned to pass through a cochleostomy incision of a size that retains hearing of the subject.



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ELECTRODE INSERTION DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This U.S. patent application claims benefit of U.S. provisional patent application having Serial Number 61/105,329, filed on October 14, 2008, which provisional application is incorporated herein by specific reference in its entirety.

BACKGROUND

Hearing impairment is major problem that is difficult to repair. Once a person has lost some or all of their hearing, it is difficult to improve the ability to hear. Hearing aids, such as external hearing devices, have been developed to boost the ability of a person to hear, but most hearing aids are insufficient. Surgical techniques to improve hearing have been developed to improve the hearing ability of people that are hearing impaired. These surgical techniques may include implanting a hearing device.

Currently, there are three hearing implants available: Advanced Bionics; Med El; and Nucleus. However, the present devices or methods of implantation are not optimal, and improvements need to be made. A major problem in attempting to place an electrode into the ear is the electrode wire buckling and bending, and thereby inhibiting insertion. Such bending is a result of the thinness of the electrode wires needed for placement into the ear. Such bending and buckling makes it nearly impossible to accurately and repeatably place an electrode into the cochlea. Currently, electrodes are attempted to be placed within the inner ear by grasping the electrode wires with forceps, and advancing the wire through an incision with the forceps.

Currently, there are no medical devices sufficient for delivery of an electrode into the inner ear, which can be passed through a small incision that retains any residual hearing.

BRIEF SUMMARY OF THE INVENTION

In one embodiment, a medical device can be configured for delivering an electrode into an inner ear of a subject while retaining the hearing of the subject. Such a medical device can be an electrode wire delivery device that includes: an elongate member having an electrode wire receiving surface; and a covering member removably coupled to the elongate member so as to form an internal lumen for receiving an electrode wire, wherein the medical device has a cross-sectional profile dimensioned to pass through a cochleostomy incision of a size that retains hearing of the subject. The elongate member can be configured to provide structural support to the electrode wire while being passed through the cochleostomy incision such that the electrode wire does not buckle. For example, the elongate member can be flexibly rigid enough for delivery of the electrode wire without it buckling. As such, the elongate member is more rigid than the electrode wire. Also, the elongate member can have a cross-sectional dimension that is about 0.5 mm to about 1.5 mm.

In one embodiment, the internal lumen can be coated with a lubricant. For example, the lubricant can be hyaluronic acid or the like.

In one embodiment, the internal lumen can be coated with an active agent. For example, the active agent can be an anti-inflammatory such as a non-steroidal anti-inflammatory drug (NSAID) or it can be a steroid.

In one embodiment, the elongate member and/or covering member independently is a metal, alloy, plastic, polymer, rubber, elastomer, plastomer, ceramic, composite, shape memory material, or combination thereof.

In one embodiment, the medical device (e.g., elongate member and/or covering member) includes a distal tip that is blunt, scalloped, rounded, or pointed.

In one embodiment, the elongate member can include a handle with an ergonomic shape.

In one embodiment, the covering member can be removably coupled with the elongate member.

In one embodiment, the covering member can be configured to provide structural support to the electrode wire while being passed through the cochleostomy incision.

In one embodiment, the covering member can be configured to retain the electrode wire on the receiving surface while being passed through the cochleostomy incision.

In one embodiment, the invention can include a method of implanting an electrode into an inner ear of a subject while retaining hearing. The method can include: providing an electrode wire delivery device as described herein that has an electrode wire located within the internal lumen; forming an incision in the round window of the inner ear, said incision having a size that retains hearing of the subject; inserting the electrode wire through the incision into the inner ear with the delivery device so as to implant the electrode in the inner ear while retaining hearing of the subject; removing the covering member from the elongate member; and withdrawing the covering member and elongate member from the incision.

In one embodiment, the electrode wire and delivery device can be inserted to a depth of up to 30 mm.

In one embodiment, the delivery device can also be configured for delivering an active agent along with the electrode wire.

The method can also include coupling the elongate member and the covering member together. This can include inserting the electrode wire into the internal lumen before, during or after coupling the elongate member with the covering member.

BRIEF DESCRIPTION OF THE DRAWINGS

To further clarify the above and other advantages and features of the present invention, a more particular description of the invention will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. It is appreciated that these drawings depict only illustrated embodiments of the invention and are therefore not to be considered limiting of its scope. The invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

Figure 1 is a schematic representation of an electrode delivery device configured for receiving an electrode and insertion through a cochleostomy.

Figures 2-11 are cross-sectional profiles of embodiments of electrode delivery devices.

Figures 12-15 are side profiles of embodiments of electrode delivery device tips.

Figure 16 is a graph showing retention and preservation of hearing at all frequencies after insertion up to 28 mm and implantation of a wire electrode with the present invention.

DETAILED DESCRIPTION

Generally, the present invention provides a medical device and method of use for delivering an electrode during a cochlear implant surgery. The medical device can be used during an implant surgery to deliver an electrode while preserving residual hearing. The medical device can be used to facilitate implantation of thin electrode wires that are sized to be atraumatic at the ear. The thin electrode wires that are atraumatic are flimsy and difficult to manipulate and maneuver without some assistance. That is, the electrode wires themselves are too flimsy to be successfully delivered into the ear, such as during a cochlear implant surgery, without some mechanical reinforcement to keep the electrode wires from bending and collapsing. Accordingly, the medical device of the invention is designed to facilitate the use of the thin electrodes in an atraumatic fashion for delivery into the inner ear.

The problem of delivering electrodes into the inner ear or cochlea has developed recently with the advances in cochlear implants and implantation techniques that preserve residual hearing. Rather than making a large cochleostomy that allows easy implant placement, cochleostomy size is reduced so as to retain any residual hearing that has not been lost. As a consequence, the size of the cochleostomy has reduced the ability of electrode wires, which themselves are extremely small and tend to buckle and bend, to be accurately placed into the inner ear or cochlea. Now, the present invention can be used to accurately place electrodes into the inner ear or cochlea. The medical device provides structural support to an electrode that is sized with thin wires for placement into the inner ear or cochlea. Also, the medical devices includes a holding member or carrier that holds the electrode wire in place on the medical device during deliver, where the carrier can be manipulated to release the electrode wire from the medical device. The medical device can then be retracted while leaving the electrode in place with the electrode wires extending through the incision.

The medical device holding the electrode can be beneficial for enhancing the surgical technique. The medical device speeds up the implantation by allowing the electrode to be easily passed through a small cochleostomy. Also, the medical device allows for electrode placement with retention of any hearing the patient may have. The preservation of hearing is of utmost importance. Also, the ability of

preserving any hearing greatly increases the number of candidates for cochlear electrode implantation.

In one embodiment, the present invention can include a medical device for delivering an electrode into an inner ear of a subject. Figure 1 shows an embodiment of a medical device 10, which is described in more detail below. Figure 1 shows a medical device 10 having an elongate member 12 (e.g., carrier) that includes a proximal handle 13 and a distal groove 15 configured for receiving the electrode wire 2. A sheath 14 is included at the distal end such that the sheath and groove 15 form a lumen 16 for retaining the wire 2.

Figure 2 shows a cross-sectional profile of the medical device 10 of Figure 1. Also, shown are the receiving surface 18 and the coupling intersection 20 between the elongate member 12 and the sheath 14.

Generally, Figures 1 and 2 show an embodiment of the medical device that has a trough-shaped elongate member and a corresponding “C” shaped removable plastic sheath. As such, the elongate member has a substantially “C” shape and the removable plastic sheath has a corresponding “C” shape that can slidably fit over the elongate member. Also, the removable plastic sheath can have enough flexibility to be snap-fit over the elongate member.

Figure 3 illustrates an embodiment of a medical device 30 where the carrier 32 is substantially tubular so that the wire 2 is retained within a lumen of the tube. The carrier 32 includes a receiving surface 34 adapted to carry and retain the wire. During use, the wire 2 can be inserted into the carrier 32 to rest on the receiving surface, and after placement, the carrier 32 can be withdrawn over the wire electrode 2.

The medical device can include an elongate member configured as a carrier and having an electrode wire receiving surface, said carrier having a dimension configured to pass through a cochleostomy incision of a size that retains hearing of the subject. The electrode receiving surface can be in a shape configured for receiving and retaining the electrode wire, which is small and of the size to fit within the inner ear or cochlea. The carrier can be shaped and/or sized and/or made of a material sufficient to provide structural support to the electrode wire while being passed through the cochleostomy incision. This can include the carrier being flexibly rigid or rigid. For example, the carrier is more rigid than the electrode wire.

The size of the carrier can include a cross-sectional dimension that is about 0.5 mm to about 1.5 mm.

The carrier can be configured in to a variety of shapes and sizes. This can include the carrier having a handle portion that is proximally located and a distal portion that is configured to retaining the wire. The cross section of the handle portion and distal portion can be the same or different. The cross-section of the handle can be cylindrical, tubular, polygonal, ergonomic, portions thereof, or the like. The cross-section of the distal portion can be any shape for carrying the wire, such as those shown in Figures 4-11. For example, the handle can be cylindrical and the distal portion can be in the shape of a "C".

Figure 4 shows an embodiment of a medical device 40 having a carrier 42 and a sheath 46. The carrier 42 is "C" shaped with an internal receiving surface 44 for holding the wire 2. The sheath 46 is removably coupled to the carrier 42 via a coupling intersection 48 that includes a portion of the sheath 46 wrapping part of the carrier 42. The carrier 42 and sheath 46 cooperate to form an internal lumen.

Figure 5 shows an embodiment of a medical device 50 having a carrier 52 and a flat sheath 56. The carrier 52 is "C" shaped with an internal receiving surface 54 for holding the wire 2. The sheath 56 is flat and covers the wire 2 and is adhered to the carrier 52 through a coupling intersection 5 by an adhesive 48 that can be peeled from the carrier 52. The carrier 52 and sheath 56 cooperate to form an internal lumen.

Figure 6 shows an embodiment of a tubular medical device 60 having a carrier 62 and a sheath 66. The carrier 62 is "C" shaped with an internal receiving surface 64 for holding the wire 2. The sheath 66 is also "C" shaped so that the carrier and sheath 66 cooperate to form a tubular medical device 60 with an internal lumen. The sheath 66 and carrier 62 include a coupling intersection 68 that includes a portion of the sheath 66 coupling the carrier 62. The coupling intersection 68 can be any type of removable coupling, such as an adhesive, tongue and groove, magnet, or the like.

Figure 7 shows an embodiment of a friction-fit medical device 70 having a carrier 72 and a sheath 76 that are friction-fit together. The carrier 72 is "C" shaped with an internal receiving surface 74 for holding the wire 2, and made of a material to be rigid. The sheath 76 is also "C" shaped and has a body that is made of a material that is more flexible than the carrier 72, which allows for the sheath 76 to

be flexed or bend and pulled away to release the friction-fitting and remove the sheath 76 from the carrier 72. Accordingly, the coupling intersection 78 that includes a portion of the sheath 76 that applies friction with the carrier 72 to hold the medical device together during insertion of the wire 2, but allows for the sheath 76 to be released from the carrier for removal of the medical device.

Figure 8 shows an embodiment of a medical device 80 having a carrier 82 and a wrapped sheath 86. The carrier 82 is “U” shaped with an internal receiving surface 84 for holding the wire 2. The sheath 86 is configured as a wrapping, that is wound around the carrier 82 which can then be unwound for removal. The sheath 86 can include a peelable adhesive 88 that holds the wound body together and to the carrier 82.

Figure 9 shows an embodiment of an interlocking medical device 90 having a carrier 92 and a sheath 96 that interlock together to hold the wire. The carrier 92 includes an internal receiving surface 94 for holding the wire 2. The sheath 96 can include wings 98 that wrap partly around the carrier 92, which wings are flexible and bendable to release the carrier 92 after deployment of the wire 2. the wings 98 can allow the carrier 92 to be pulled from the sheath during withdrawal while the sheath retains the wire 2 in place. The sheath can then be extracted.

Figure 10 shows an embodiment of a shape memory medical device 100 having a carrier 102 and a sheath 106. Below body temperature, the carrier 102 is “C” shaped with an internal receiving surface 104 for holding the wire 2, and the sheath 106 is a corresponding closed “C” shape with coupling intersection 108 that forms from the two opposing portions of the sheath 106 that wrap around the carrier 102. At body temperature or higher, at least the sheath 106 changes shape to uncouple the coupling intersection 108 and allow for the carrier 102 and sheath 106 to release the wire 2, and withdrawal of the medical device. Also, the carrier 102 can be similarly be made of a shape memory material that changes shape.

Figure 11 shows an embodiment of a medical device 110 having a carrier 112 and a sheath 116. The carrier 112 is a rigid member having a surface 114 that contacts the wire, and is substantially more rigid than the wire. The sheath 116 can be tubular in shape with a slit 118 that can be separated for the sheath 116 to be removed from the carrier 112. The sheath 116 more flexible compared to the carrier 114 such that the sheath 116 retains the wire 2 and the carrier provides structural integrity during implantation.

The configurations of the carrier and sheath can be varied as long as together, the wire can be implanted, and then the carrier and sheath can be withdrawn after implantation of the wire. For example, the distal portion of the carrier and/or sheath can include a slit for receiving and releasing the electrode wire.

In one embodiment, the handle can be bent away from the distal portion so that the medical device can be easily handled. Also, the handle can be an ergonomic shape.

In one embodiment, the electrode wire receiving surface can include a recess, slot, groove, or other electrode receiving and retaining configuration. The recess can include a recess opening with a cross-sectional dimension that is about 0.5 mm to about 1 mm. For example, the recess cross-sectional profile can be substantially “C” or “U” or “V” shaped. Alternately, the receiving surface can include an aperture, lumen, conduit, or other closed or substantially closed feature. An example of a closed feature can include a cross-sectional profile that is “O” shaped, which is closed or substantially closed. The receiving surface can be substantially the same cross-section profile as the carrier.

In one embodiment, the medical device can include a carrier having an electrode wire receiving surface as described herein and a covering member or sheath that covers the electrode wire receiving surface so as to provide an electrode wire conduit disposed between the carrier and the covering member. The covering member can be removably coupled with the carrier.

In one embodiment, the carrier can be more flexible while the sheath is configured to be more rigid in order to provide structural support to the electrode wire while being passed through the cochleostomy incision.

In one embodiment, the sheath can be configured to retain the electrode wire on the receiving surface of the carrier while being passed through the cochleostomy incision. As such, the sheath can apply a pressure to the wire against the receiving surface to facilitate retention of the wire so that it does not slip during implantation. The carrier and sheath can thereby have a friction-fitting for wire retention.

In one embodiment, the carrier can provide the structural stability and the sheath can be flexibly rigid and more flexible than the carrier. Also, the sheath can be substantially flimsy like a peelable liner. Optionally, the sheath can be more rigid than the electrode wire; however, it can be less rigid when the carrier is comparatively more rigid.

In one embodiment, the sheath can also include an electrode receiving surface that is a recess. For example, the recess of the sheath has a recess opening with a cross-sectional dimension that is about 0.5 mm to about 1 mm. Also, the recess of the sheath can be substantially “C” shaped or any shape of the carrier.

In one embodiment, the medical device can include a distal tip having a variety of shapes and configurations for insertion through an incision. The distal tip can include the carrier and/or sheath having a shape or configuration. The distal tip can be square, blunt, scalloped, rounded, offset, sloped, wedge, tapered, pointed, sharp, dull, or the like. Examples of the distal tip shape can be found in Figures 12-15. Figure 12 includes a distal tip 120 that has a squared distal surface 122. Figure 13 includes a distal tip 130 that has a scalloped distal surface 132. Figure 14 includes a distal tip 140 that has a rounded distal surface 142. Figure 15 includes a distal tip 150 that has a wedge-shaped distal surface 152. Other distal tip shapes can be used.

In one embodiment, the receiving surface can be coated with a lubricant. The lubricant can aid in placement of the electrode such that the receiving surface and electrode can be slid with respect to each other with reduced friction. The lubricant can be any medically-compliant lubricant that is safe and/or biocompatible. For example, the lubricant can be hyaluronic acid.

In one embodiment, the medical device, such as the carrier, sheath, receiving surface, external surface, or any other aspect, can be coated with a biologically active agent, such as a drug. Accordingly, the medical device can facilitate the delivery of a biologically active agent into the site where the electrode is passed and for implantation. The drug can be any of a variety of drug types, such as pain reliever, analgesic, anesthetic, anti-inflammatory, nonsteroidal anti-inflammatory, steroidal, or the like. For example, the drug can be a steroid.

In one embodiment, the medical device components, such as the elongate member and/or sheath can be any of a variety of materials that are used in medical devices, such as those that are biocompatible and capable of being inserted into a patient through an incision. For example, the material can be a metal, alloy, plastic, polymer, rubber, elastomer, plastomer, ceramic, composite, shape memory material, or any other material. Also, the elongate member and sheath can be made of different materials with different flexibilities. This can include the elongate member

which functions as a wire carrier being a more rigid metal and the sheath being a more flexible plastic.

When the medical device includes a shape memory material, the carrier and/or sheath can change shape and cross-sectional profile after being inserted into a body. As such, the temperature of the body can include a change in the shape memory material such that the medical device changes shape after the temperature increase to release the wire. Accordingly, the carrier, sheath, and/or electrode wire receiving surface can be closed at a first temperature and then open at a second temperature, wherein the first temperature is below body temperature and the second temperature is about or above body temperature. For example, the medical device can include a carrier that has a cross-sectional profile substantially in the shape of a cylinder at a first temperature and substantially in the shape of a “C” or planar at a second temperature, wherein the first temperature is below body temperature and the second temperature is about or above body temperature. This configuration can be used without a sheath such that the carrier opens upon reaching a predetermined temperature so that the carrier can be extracted while leaving the wire implanted.

In one embodiment, the sheath can form a sleeve around the carrier. The sheath can then be pulled proximally from the carrier such as a sleeve being removed from an arm. Also, the sleeve can include peelable adhesive removably coupling the carrier to the sheath.

In one embodiment, a friction fitting removably couples the sheath to the carrier. The sheath can include a slit that allows the sheath to be peeled from the carrier.

In one embodiment, a distal portion of the carrier has a cross-sectional profile in the shape of a “C” and the sheath has a cross-sectional profile of a splittable sleeve.

The insertable portion of the medical device is sized to be atraumatically delivered into the cochlea so as to preserve residual hearing, however, the handle can be of any shape and size. For example, the diameter of the insertable portion can be about 0.5 mm to about 5 mm, more preferably from about 0.6 mm to about 2.5 mm, and most preferably from about 0.75 to about 1 mm. In one example, the diameter is about 1 mm.

For example, the length of the insertable portion or trough (i.e., electrode retaining surface) can be about 0.5 cm to about 5 cm, more preferably from about 1

cm to about 3 cm, and most preferably from about 0.75 cm to about 2 cm. In one example, the diameter is about 1 cm.

In another example, the trough or receiving surface can have a dimension so as to hold an electrode wire having a diameter about 0.25 mm to about 1.25 mm, more preferably from about 0.5 mm to about 1 mm, and most preferably from about 0.7 mm to about 0.8 mm.

In another example, the sheath can have a diameter of about 0.5 mm to about 5 mm, more preferably from about 0.6 mm to about 2.5 mm, and most preferably from about 0.75 to about 1 mm. In one example, the diameter is about 1 mm.

In one embodiment, the present invention provides a guide for the insertion of flexible cochlear implant electrodes into the inner ear. The guide can include an elongate member that is configured to guide the placement of an electrode through a small cochleostomy incision. As shown in Figures 1 and 2, the guide can include an elongate member that has proximal and distal ends/tips with a recess extending therebetween. The recess of the elongate member is shaped to as to receive an electrode wire therein. Also, the guide can include a removable sheath that can hold the electrode wire within the recess during placement, and can be removed to release the electrode wire after placement. The sheath can be made of any material. For example, the sheath can be polymeric and peelable or slidable from the guide.

In one embodiment, the distal end and/or tip of the elongate member can be substantially straight so as to be capable of extending straight through a cochleostomy incision and so that the distal tip can be placed at the site of implantation of the electrode. Optionally, the distal end and/or tip can be curved so that the tip can be inserted through a cochleostomy incision and then directed to an implant site that is not aligned in a straight path from the cochleostomy incision.

In one embodiment, the proximal end and/or tip of the elongate member can be straight so as to be aligned with the distal end and/or tip. However, the proximal end can have any configuration, such as those that facilitate handling. That is, the proximal end and/or tip can be bent to facilitate handling or can have an ergonomic configuration.

In one embodiment, the removable plastic sheath can be configured as a sleeve that slides over the elongate member. The sleeve can fully or partially encompass the circumference of the elongate member. For example, the sleeve can have a "C" shape that slides over or snaps over the elongate member.

In one embodiment, the removable plastic sheath can be a removable (e.g., peelable) plastic layer that is disposed over the mechanically-stable elongate member (e.g., atraumatic sized). The plastic layer can be configured so as to provide a conduit for the electrode wire with the elongate member. The plastic layer can be removably adhered to the elongate member via adhesives, such as adhesives that are commonly employed in peelable applications. This can allow for the plastic layer to be peeled away from the elongate member at any point during the placement of the electrode. The plastic layer can then be removed so that the electrode is retained within the cochlea after the mechanically-stable elongate member is retracted from the cochlea. This leaves the electrode in place within the cochlea.

In one embodiment, the medical device includes an elongate member having a recess for retaining an electrode wire, a sheath for forming a conduit with the recess, and the electrode having the electrode wire.

In one embodiment, the sheath can be a flexible plastic that can be pulled over the elongate member. The sheath can cover all of the elongate member or the trough, or portions thereof. For example, the sheath can cover from about 50% to about 100% of the trough, more preferably from about 75% to about 95%, or most preferably about 85% to about 90% of the trough.

In one embodiment, the invention can include a method of manufacturing a medical device configured for inserting an electrode wire into an inner ear of a patient. The method can include: forming an elongate member as a wire carrier in accordance with any one of the carrier embodiments described herein having a receiving surface; forming a sheath in accordance with any one of the sheath embodiments described herein; and coupling the sheath to the carrier. The wire can be inserted into the medical device before, during or after coupling the sheath to the carrier.

In one embodiment, the invention can include a method of implanting an electrode into an inner ear of a subject. Such a method can include providing a medical device in accordance with any one of the embodiments described herein that retains an electrode wire; inserting the medical device retaining the electrode wire into the inner ear so as to implant the electrode in the inner ear; and removing the medical device. In order to remove the medical device, the carrier can be disengaged from the wire and slid from the wire. Also, the carrier can be uncoupled

from the sheath so that the sheath and/or carrier can be withdrawn together or independently from each other.

Generally, there are two ways of inserting the electrode into the cochlea. First, a medical practitioner can drill a hole through the bony part of the ear. Alternatively, the medical professional can make a little slit in a membrane called the round window, where the slit is small and about the size of the medical device.

During the implantation, the medical device and electrode can make multiple turns to reach the end. The end of the cochlea is much narrower so a very, very thin electrode can be used to be able to reach that high up. As the medical device and electrode are advanced, they make turns to reach the end.

Figure 16 shows data from a medical procedure where an electrode wire was implanted with the medical device of the present invention. The data shows that complete preservation of hearing at all frequencies was retained after complete insertion of the wire with the medical device up to 28 mm. There may be conductive hearing loss, because of the decreased the amount of perilymph in the cochlea like filling the space and because of the change of the traveling wave in the cochlea due to the wire. The medical device can be used to insert an electrode without making a patient deaf, which is surprising and unexpected.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope. All references recited herein are incorporated herein by specific reference in their entirety.

What is claimed is:

CLAIMS

1. A medical device for delivering an electrode into an inner ear of a subject, the medical device comprising:
 - an elongate member having an electrode wire receiving surface;
 - a covering member removably coupled to the elongate member so as to form an internal lumen for receiving an electrode wire,wherein the medical device has a cross-sectional profile dimensioned to pass through a cochleostomy incision of a size that retains hearing of the subject.
2. A medical device as in claim 1, wherein the elongate member is configured to provide structural support to the electrode wire while being passed through the cochleostomy incision such that the electrode wire does not buckle.
3. A medical device as in claim 2, wherein the elongate member is at least flexibly rigid.
4. A medical device as in claim 2, wherein the elongate member is more rigid than the electrode wire.
5. A medical device as in claim 1, wherein the elongate member has a cross-sectional dimension that is about 0.5 mm to about 1.5 mm.
6. A medical device as in claim 1, wherein the lumen is coated with a lubricant.
7. A medical device as in claim 6, wherein the lubricant is hyaluronic acid.
8. A medical device as in claim 1, wherein the lumen is coated with an active agent.
9. A medical device as in claim 8, wherein the active agent is a steroid.
10. A medical device as in claim 1, wherein the elongate member is metal, alloy, plastic, polymer, rubber, elastomer, plastomer, ceramic, composite, shape memory material, or combination thereof.
11. A medical device as in claim 1, wherein the medical device includes a distal tip that is blunt, scalloped, rounded, or pointed.
12. A medical device as in claim 1, wherein the elongate member includes a handle with an ergonomic shape.
13. A medical device as in claim 1, wherein the covering member is removably coupled with the elongate member.

14. A medical device as in claim 3, wherein the covering member is configured to provide structural support to the electrode wire while being passed through the cochleostomy incision.

15. A medical device as in claim 13, wherein the covering member is configured to retain the electrode wire on the receiving surface while being passed through the cochleostomy incision.

16. A method of implanting an electrode into an inner ear of a subject, the method comprising:

providing an electrode wire delivery device that includes:

an elongate member having an electrode wire receiving surface;

a covering member removably coupled to the elongate member so as to form an internal lumen for receiving an electrode wire; and

an electrode wire located within the internal lumen;

forming an incision in the round window of the inner ear, said incision having a size that retains hearing of the subject;

inserting the electrode wire through the incision into the inner ear with the delivery device so as to implant the electrode in the inner ear while retaining hearing of the subject;

removing the covering member from the elongate member;

withdrawing the covering member and elongate member from the incision.

17. A method as in claim 16, wherein the electrode wire and delivery device are inserted to a depth of up to 30 mm.

18. A method as in claim 17, further comprising delivering an active agent along with the electrode wire.

19. A method as in claim 17, further comprising coupling the elongate member and the covering member together.

20. A method as in claim 19, further comprising inserting the electrode wire into the internal lumen before, during or after coupling the elongate member with the covering member.

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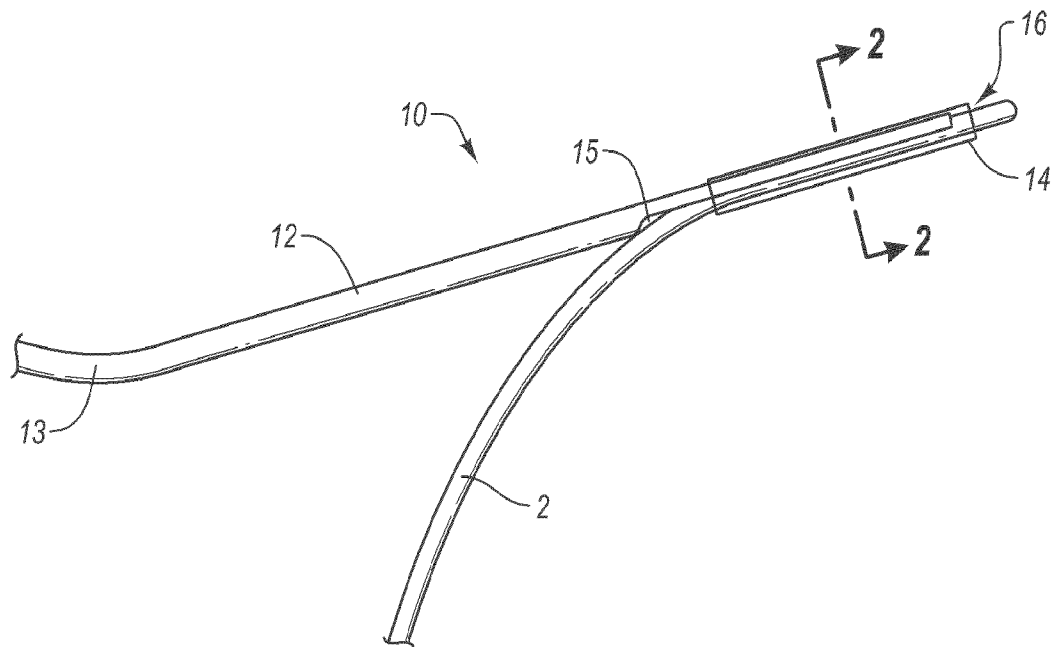


Figure 1

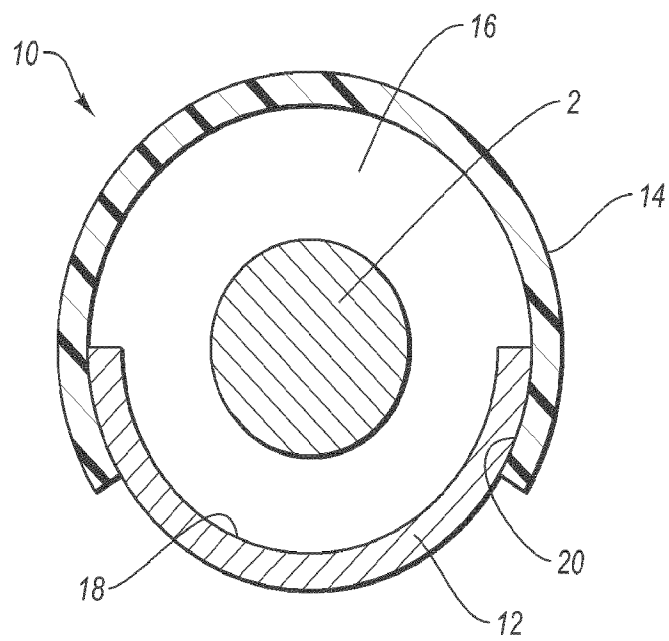


Figure 2

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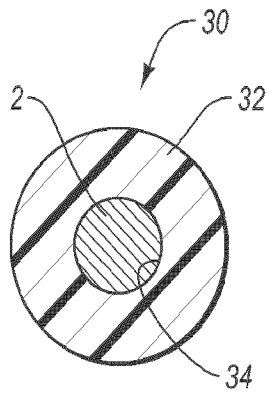


Figure 3

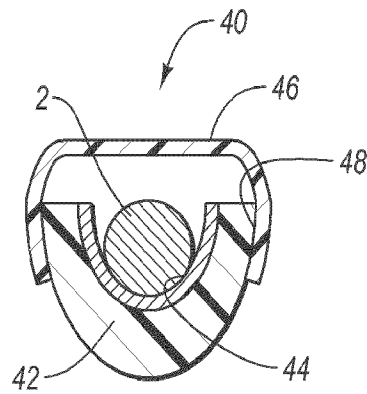


Figure 4

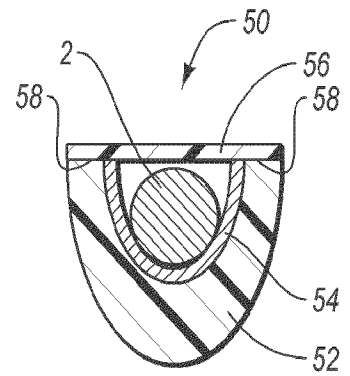


Figure 5

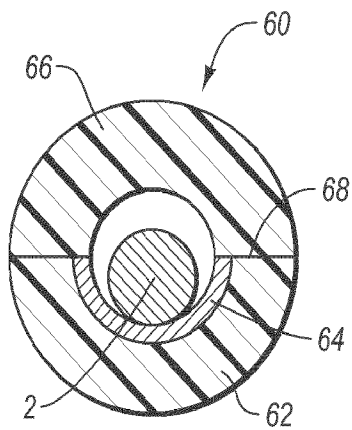


Figure 6

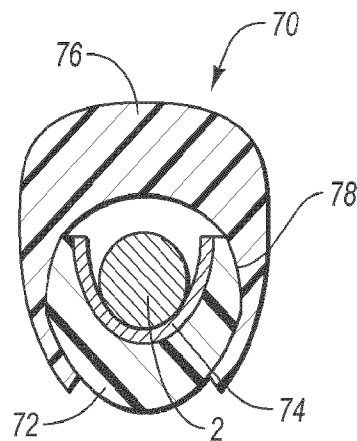


Figure 7

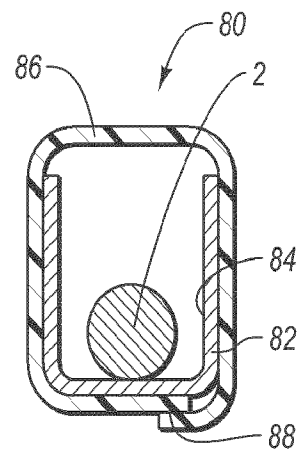


Figure 8

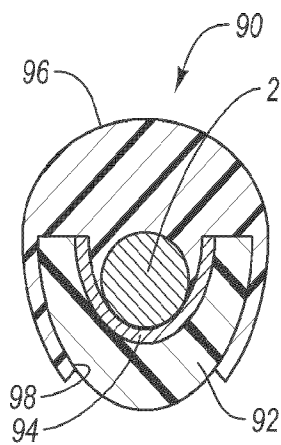


Figure 9

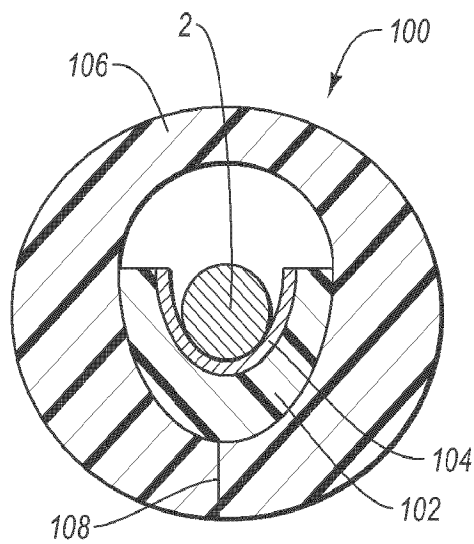


Figure 10

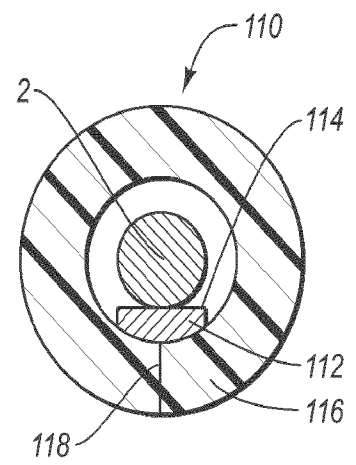
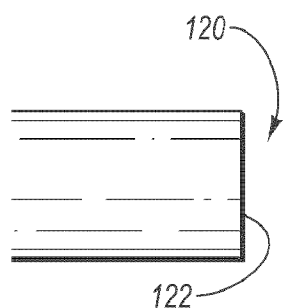
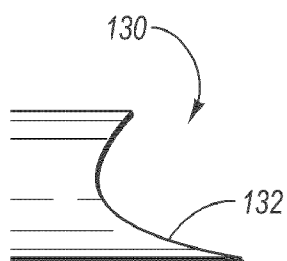
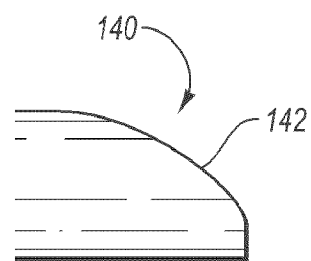
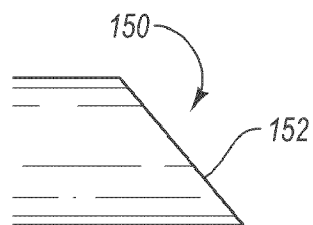
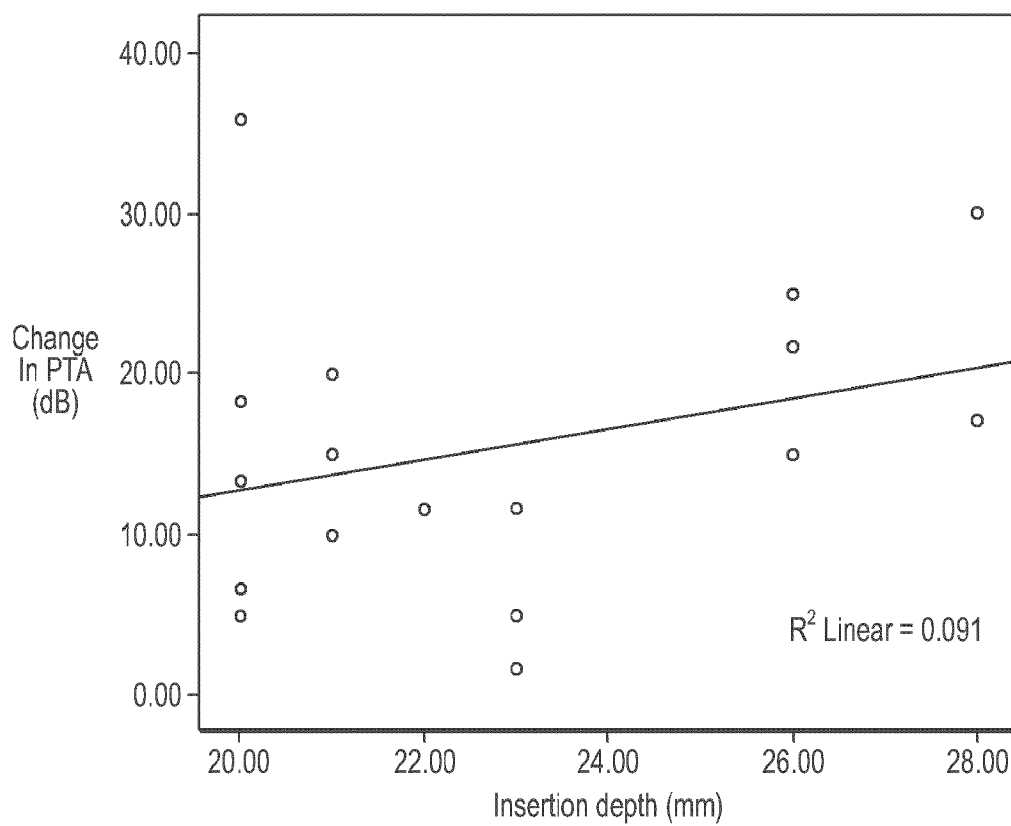


Figure 11

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**Figure 12****Figure 13****Figure 14****Figure 15****Figure 16**