Paul M. Rady Mechanical Engineering
UNIVERSITY OF COLORADO BOULDER

Transcanal Endoscopic Cochlear Implantation Instrument (TECII)

Brian Ahn, Shannon Blanco, Matthew Cervino, Annie Deschane, Kai Groudan, Emma Nicolaou, Nathan Rhodes, Kelly Smith, Isaiah Straubel

Children's Hospital Colorado

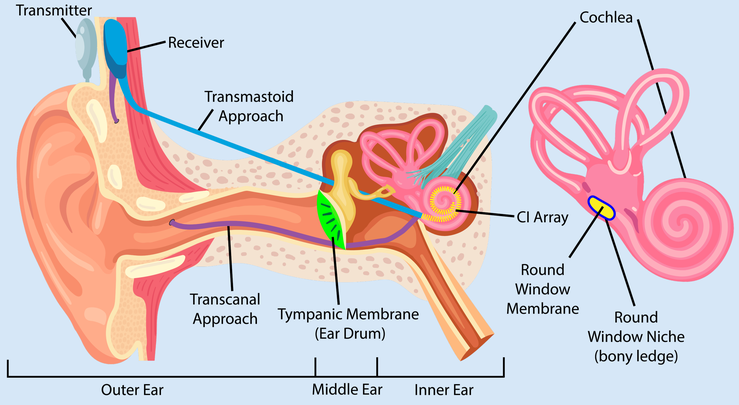
Objective

The goal of the TECII is to create a device that will streamline the cochlear implant procedure. This will help to reduce surgical duration, intraoperative risks and potential for adverse surgical outcomes

Background

- Over half the population has a form of sensorineural hearing loss by the age of 80
- Upwards of 180,000 people use a cochlear implant to aid in hearing throughout the United States
- The current transmastoid surgical approach requires drilling through the mastoid bone
- The ear canal offers a more direct, less invasive option for CI surgery, shortening operation time and protecting the facial nerve

Inner Ear Anatomy



Design Overview

User Interface

Controls consisting of proximal buttons, distal joystick, and CI deployment switch.

Buttons
- Proximal movement

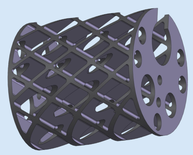
Switch
- Selects movement or CI deployment mode

Joystick
- Distal movement
- CI deployment

Movement

Consists of a series of 4 bending units separated by c-rings. Each unit containing springs for proximal and/or distal bending.

Lattices
- Provide structural support
- Mimic springs



C-rings
- Organize cables
- Protects camera, tool, and CI

Handle

Houses stepper motors, DC motor, and constant tension spring for TECII functionality control.

Stepper Motors
- Precisely pull and release bending cables

DC Motor
- Rotates deployment cable

Cable Comb and Standoff
- Safely route worm cables into the handle

Deployment Cable Tension
- Constant force spring keeps tension in deployment cable

CI Deployment

Pushes CI out of TECII and into the cochlea. Allows TECII to insert CI then leave the ear after the CI is in place.

C-cover
- Covers CI channel during navigation

Deployment Cable
- Spins the reel to advance the CI

Reel
- Linearly aligns the CI for deployment

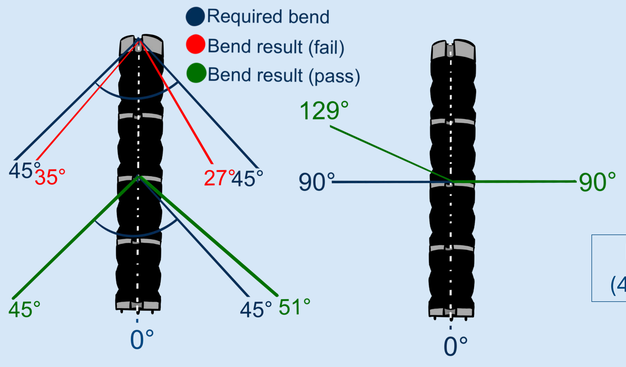
Requirements

- ❑ Complete 45° and 90° bends at the same time
- ❑ Provide an 80° field of view of the middle ear
- ❑ Integrate a light source with endoscope
- ❑ Insert the CI into the round window niche
- ❑ Remove the device while leaving the CI in the cochlea
- ❑ Ambidextrous one-handed device
- ❑ TECII inner diameter > 1 mm
- ❑ TECII outer diameter of tip < 4 mm

Testing

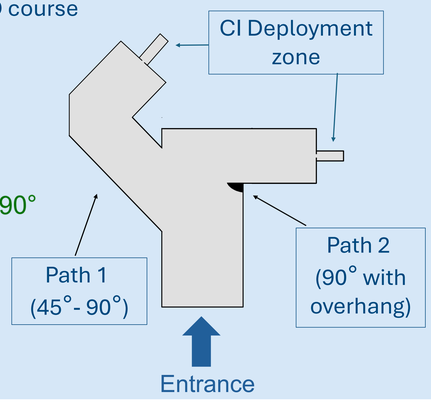
Bending

Bending trials to determine maximum achievable angle



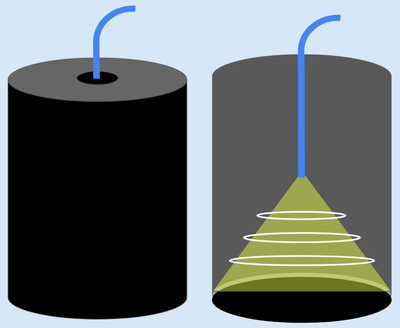
Navigation

Simulate TECII deployment and removal with 3D course



Camera Visibility

Confirmed field of view of camera within enclosed, isolated system



Future Steps

- Manufacture at true scale
- Transition to biocompatible materials
- Iterate the handle to be more ergonomic
- Integrate and miniaturize the electronics

Accomplishments

- Ability to navigate complex geometry
- Ambidextrous one-handed device
- 90° endoscopic field-of-view
- **Patent submitted**

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