**Design of Controllable Flexible Instruments to Facilitate Endoscopic Ear Surgery**

**Background:** Transcanal endoscopic ear surgery (TEES) has undergone a surge of enthusiasm in recent years due to the benefits of minimally invasive surgery and clearer access to the tympanic membrane and recesses of the tympanic cavity. However, due to the one-handed surgical technique required for TEES, the surgery is challenging especially in children. Existing instruments have not been designed to accommodate this challenge.

**Objective:** To design instruments to facilitate the challenges experienced during TEES.

**Methods:** A needs analysis questionnaire was sent to otologists internationally to evaluate the nature of limitations in currently available surgical instruments for TEES. A prototype instrument was developed to overcome the principle limitations and was evaluated in virtual and 3D printed temporal bone models. Models were constructed from 6 pediatric cases in which TEES removal of cholesteatoma from the mastoid antrum was challenging.

**Results:** We received responses from 22 endoscopic ear surgeons.The surgical difficulty of “reaching structures visualized by the endoscope” scored an average of 83% ± 4% need for new instrumentation. ANOVA with a 95% confidence interval showed that there was no significant effect of TEES experience on the difficulty experienced. A novel instrument with controllable flexion was developed and found to improve surgical access to the mastoid antrum.

**Conclusion:** We present a novel tool that can reach into the mastoid antrum through TEES atticoantrostomy, addressing a principle limitation of current surgical instrumentation. It is anticipated this tool will allow a greater proportion of pediatric cholesteatoma to be treated with TEES.