Use of the Flexible CO$_2$ Laser in Hearing Preservation Cochlear Implant Surgery

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Justin S. Golub, MD, Lisa Houston, AuD,
Theresa Hammer, AuD, Jeffrey J. Kuhn, MD
CONFLICTS OF INTEREST:

Ravi N. Samy:
MedEl- research funding
Cochlear- research funding, honoraria
Stryker- educational funding, honoraria

Justin S. Golub - Stryker: educational funding

Lisa Houston- Cochlear Advisory Board

Theresa Hammer- none

Jeffrey J. Kuhn- none

No funding from any laser companies
HEARING PRESERVATION DEPENDS ON

• Electrode array design
• Patient anatomy
• Pharmacology
• Surgical techniques
EVOLUTION OF MY USE OF THE CO2 LASER IN OTOLOGIC SURGERY:

1. OTOSCLEROSIS

2. CHRONIC EAR SURGERY

3. COCHLEAR IMPLANTATION
USES FOR LASER IN CI SURGERY

1. REDUCES VASCULARITY AROUND PROMONTORY

2. ERADICATE EXTRACOCHLEAR SOFT TISSUE

3. ASSISTANCE IN LABYRINTHITIS OSSIFICANS

4. NO TOUCH TECHNIQUE TO PERFORATE ENDOSTEUM / RW
HYPOTHESIS: USE OF A LASER IN COCHLEAR IMPLANT SURGERY:

1. IS SAFE

2. HELPS PRESERVE HEARING / IMPROVES OUTCOMES
METHODS

• IRB approval
• Retrospective study (07/10-11/14)
• Adults only, single-surgeon
• n=92 (laser cochleostomy/RW approach)
• Exclusion criteria: NF2, revision surgery
SOFT SURGICAL TECHNIQUE

• TRANSTYMPANIC STEROIDS
• TAKE DOWN ROUND WINDOW OVERHANG
• KEEP SURGICAL FIELD DRY
• USE ROSETTE PATTERN ON ROUND WINDOW
  – CONTINUOUS / SINGLE PULSE MODE: 2-4 WATTS
• NO SUCTIONING OF PERILYMPH
• INSERTION OF ELECTRODE > 1 MINUTE
RESULTS

• FIRST 2 YEARS OF STUDY:
  – NO HEARING PRESERVATION ATTEMPTED
  – N=15

• LAST 2 YEARS OF STUDY:
  – HEARING PRESERVATION ATTEMPTED WHEN APPROPRIATE
  – N=77
    • N=13 ADEQUATE PRE AND POSTOP AUDIOS
DEVICE TYPES

<table>
<thead>
<tr>
<th>Company</th>
<th>Number</th>
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<tbody>
<tr>
<td>AB</td>
<td>5</td>
<td>5%</td>
</tr>
<tr>
<td>Cochlear</td>
<td>62</td>
<td>67%</td>
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<tr>
<td>Med El</td>
<td>19</td>
<td>21%</td>
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<tr>
<td>TOTAL</td>
<td>92</td>
<td>100%</td>
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54% left ear, 46% right
Average age: 61 years (+/- 15)
RESULTS: SAFETY

• NO FACIAL NERVE INJURIES
  – IMMEDIATE OR DELAYED

• NO OTHER PERIOPERATIVE ADVERSE EVENTS
<table>
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<th>CNC</th>
<th>Postop Day #</th>
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<tr>
<td>422</td>
<td>53 ±26%</td>
<td>256 ±134</td>
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<td>Contour Advance</td>
<td>64 ±21%</td>
<td>321 ±255</td>
<td>14</td>
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<tr>
<td>Med El Flex</td>
<td>50 ±15%</td>
<td>232 ±180</td>
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<td>266 ±136</td>
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<tr>
<td>Contour Advance</td>
<td>71 ±18%</td>
<td>220 ±144</td>
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<tr>
<td>Med El Flex</td>
<td>69 ±13%</td>
<td>262 ±211</td>
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<tr>
<td>ELECTRODE</td>
<td>250 Hz</td>
<td>500 Hz</td>
<td>1000 Hz</td>
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<td>--------</td>
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<tr>
<td>HR90K Mid Scala</td>
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<td>-5</td>
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<tr>
<td>Cont Adv</td>
<td>X</td>
<td>X</td>
<td>X</td>
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HYBRID-L (n=7): all with preserved hearing still using acoustic component
COMPARABLE DIAMETER

Omniguide Oto-S fiber

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<tr>
<th>Nominal outer diameter of distal portion of fiber assembly</th>
<th>0.55 mm</th>
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<td>Nominal Spot size at tip output</td>
<td>0.25 mm</td>
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DISADVANTAGES TO USE OF LASER

• COST OF DISPOSABLE FIBER

• LASER SAFETY PERSONNEL

• LASER SAFETY TRAINING
  RISK OF FIRES
DOWNSIDES TO OUR STUDY

• RETROSPECTIVE

• LIMITED NUMBER OF CASES

• PLAN: PROSPECTIVE, RANDOMIZED STUDY BETWEEN LASER /
LITERATURE

Cipolia MJ, et. al. Modification and comparison of minimally invasive cochleostomy techniques. 
*Laryngoscope* 2012.


HYPOTHESIS: USE OF A LASER IN COCHLEAR IMPLANT SURGERY:

1. IS SAFE
   - YES

2. HELPS PRESERVE HEARING / IMPROVES OUTCOMES
   - PERHAPS
“Courage is what it takes to stand up and speak; courage is also what it takes to sit down and listen.”
—Winston Churchill