Bimodal and bilateral benefits in CI adults: towards evidence-based guidelines for recommending bilateral implantation

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For normally-hearing listeners:

- Well-known benefits to **binaural hearing**
- **ITD** and **IID** cues for localisation
- **Binaural summation** of loudness
- **Binaural release from masking** for listening in background noise
For bilateral and bimodal CI users:

- **Bimodal advantage** found for speech perception, localisation, daily function compared to monaural CI use
- **Bimodal and bilateral** CI users are able to access binaural squelch, binaural summation advantages
- Studies show **no clear advantage** for either mode of stimulation
- Available literature limited by **small sample sizes**
Study summary

• **Bimodal** speech perception benefit compared to CI alone
• **Bilateral** speech perception benefit compared to CI alone
• Compare *bimodal* and *bilateral* benefit
• Speech perception benefit measured using **CNC word scores**
Methodology

- **Clinical** speech perception data on all adults with acquired hearing loss who received a CI between 2000–2015 in Melbourne
- Two groups:
  - N=650 who used hearing aids with their CI
  - N=157 who received a second CI
- Complete data available for **post-CI at 3 months** for monaural and binaural conditions
- This study focuses on **CNC word scores**
Results

- **Condition**
  - Preop implant ear
  - Preop max score
  - CI alone
  - CI+HA
  - CI+CI

- **CNC word score (%)**
  - 0
  - 50
  - 100

*** indicates statistically significant differences.
Results – CI+HA benefit

Bimodal benefit (%) vs Maximum word score pre-implant (%)

$r = 0.51$
$p < 0.001$
Results – Distribution of CI+CI benefit

Bilateral benefit for CNC words (%)

Density

0.020
0.015
0.010
0.005
0.000
-20 -10 0 10 20 30 40 50 60 70
Results – CI+HA vs CI+CI benefit

Bimodal benefit (%) vs Maximum word score pre-implant (%)

-20  -10   0    10   20   30   40   50   60   70   80   90   100
Results – CI+HA vs CI+CI benefit

PREOP.MAX

- $p < 0.001$

1. ≤ 41
   - $p < 0.001$
     - ≤ 14
       - $n = 240$
         - $y = 5.815$
     - > 14
       - $n = 248$
         - $y = 12.637$

2. > 41
   - $n = 134$
     - $y = 23.634$

3. Mean bilateral benefit = 19.2%
• **Significant benefit** obtained for bimodal and bilateral CI use even with tests that do not utilise spatial cues

• A comparison of bilateral and bimodal results suggests that CI users scoring `<40% for CNC words` would probably do better with a second implant

• **Additional analyses** of these data are underway