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Introduction: Programming Cochlear Implants (CI) takes a long time, more when behavioral responses are null or not reliable. Thus, different authors have developed studies of the NRI utility to find an effective MAP for auditory habilitation. Some authors have proposed that sequential behavioral programming in conjunction with electrophysiological test provide the best outcomes (Ragunathan et al 2013). Others have written that Neural Response Imaging Thresholds (tNRI) can be clinically useful for programming CI (Caner et al 2007; Akin et al 2008; Van Den Abbeele et al 2012; Akin et al 2012).

Moreover, how is known electrode position has a significant effect for the tNRI measure, with lowest thresholds at the apical end of the array because of the density of surviving neural elements and distance between electrode and neural interface (Nehmé et al 2014). But, M level patterns across the electrodes were similar to the tNRI patterns. (Han et al 2005).

One limitation of intraoperative tNRI is that thresholds are much higher than the first fitting M levels, without any correlation (Akin et al 2006) and the NRI success rate is 81% intraoperatively with significantly increasing to 96% after 6 months (Van Den Abbeele et al 2012).

Objectives

The goals of this study are: 1) to describe tNRI changes from intraoperative to 12 months of use. 2) to evaluate the relationship among tNRI and behavioral comfort/M levels up to 12 months of CI use and 3) to analyze NRI according to the site along the cochlea.

Materials and methods

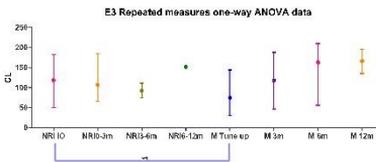
For this study we included 17 patients from Centro de Implantes Cocleares Profesor Diamante (9 adults and 8 children). All with HR90K Advantage HiFocus MS cochlear implant.

The single NRI measurement was done in odd electrodes intraoperatively, at the first month and between 3, 6 and 12 months of CI use.

Behavioral comfort levels were collected at the tune up, after 3, 6 and 12 months of use. Subjects were evaluated using the Soundwave 3.0 programming software.

All data collected were analyzed with Graph Pad Prism 6.

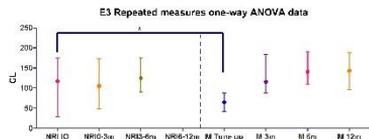
ADULTS



| | | | | | | | |
|--|--------------------|--------------------|---------------------|-----------------------|------------------|------------------|-------------------|
| Column 1 NRI IO | Column 2 NRI 3m | Column 3 NRI 6m | Column 4 NRI 12m | Column 5 M Tune up | Column 6 M 3m | Column 7 M 6m | Column 8 M 12m |
| Unpaired t test P value P value summary Significantly different? (P < 0.05) | | | | 0.0144 * | | | |

| Unconnected Fisher's LSD | Mean Diff. | 95% CI of diff. | Significant? | Summary |
|--------------------------|------------|------------------|--------------|---------|
| NRI IO vs. M Tune up | 41.30 | 8.559 to 85.03 | Yes | * |
| NRI IO vs. M 3m | 2.307 | -34.1 to 38.87 | No | ns |
| M Tune up vs. M 3m | -41.93 | -77.67 to -6.198 | Yes | ** |
| M Tune up vs. M 6m | -79.70 | -109.0 to -50.40 | Yes | *** |
| M Tune up vs. M 12m | -60.76 | -91.0 to -30.52 | Yes | *** |

CHILDREN



| | | | | | | | |
|--|--------------------|--------------------|---------------------|-----------------------|------------------|------------------|-------------------|
| Column 1 NRI IO | Column 2 NRI 3m | Column 3 NRI 6m | Column 4 NRI 12m | Column 5 M Tune up | Column 6 M 3m | Column 7 M 6m | Column 8 M 12m |
| Unpaired t test P value P value summary Significantly different? (P < 0.05) | | | | 0.0085 * | | | |

| Unconnected Fisher's LSD | Mean Diff. | 95% CI of diff. | Significant? | Summary |
|--------------------------|------------|------------------|--------------|---------|
| NRI IO vs. M Tune up | 41.30 | 8.559 to 85.03 | Yes | * |
| NRI IO vs. M 3m | 2.307 | -34.1 to 38.87 | No | ns |
| M Tune up vs. M 3m | -41.93 | -77.67 to -6.198 | Yes | ** |
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Results:

All patients have had intraoperative NRI in odd electrodes and remained stable until 6m of CI use.

We have found no statistically significant differences between intraoperative NRI and the Tune-up NRI thresholds.

The intraoperatives and Tune-up tNRI have differences statistical significant when compared to M levels at the Tune up in both groups (40 - 80 cu below). After 3 months of CI use M levels were similar to tNRI and at 6 months of CI use they were above tNRI.

tNRI were consistent and even in odd electrodes of the array. In some cases a small increase was detected in basal electrodes.

Conclusion

For the first fitting, intraoperatives tNRI are useful to follow the pattern of neural response because tNRI and M levels at the Tune-up are different statistically significant in adults and children. To find an optimal MAP we must combine objective measures with behavioral responses and set M levels below tNRI.

The single tNRI is useful as a guideline to predict M level when behavioral responses are null or not reliable, but behavioral responses are mandatory.

More studies of tNRI are necessary to estimate M levels in CI programming.