Research Abstract

**Objectives:** Indications for cochlear implantation have expanded today to include very young children and those with syndromes / multiple handicaps. Programming the implant based on behavioural responses may be tedious for audiologists in such cases, wherein matching an effective MAP and appropriate MAP becomes the key issue in the habilitation program. In ‘Difficult to MAP’ scenarios, objective measures become paramount to predict optimal current levels to be set in the MAP. This research work aimed to explore the relationship between objective measures and behavioural responses in cochlear implantees over time. The Objectives were, (a) to study the trends in multi-modal electrophysiological tests & behavioural responses sequentially over first year of implant use, (b) to generate normative data from above, (c) to correlate the multi-modal electrophysiological thresholds levels with behavioural comfort levels, and (d) to create predictive formulae for deriving optimal comfort levels (when behavioural levels are unknown), using linear & multiple regression analysis.

**Methods:** This prospective study included 58 profoundly hearing impaired children aged between 2 to 12 years, with normal inner ear anatomy and no additional handicaps. These children were categorized as per the Cochlear Implants they had received, namely - 10 with Advanced Bionics Implants, 30 with MedEl Implants and 18 with Cochlear-Nucleus Implants. These subjects underwent, Impedance Telemetry, Electrically Evoked Compound Action Potential (ECAP) Tests, Electrically Evoked Stapedial Response Telemetry.
and Electrically Evoked Auditory Brainstem Response Tests at 1, 4, 8 & 12 months of implant use, in conjunction with psychophysical behavioural Mapping. Trends in electrophysiological & behavioural responses were analyzed using the paired t-test. By Karl Pearson’s correlation method, electrode-wise correlations were derived for ECAP thresholds versus Comfort Levels and offset based (apical, mid-array & basal array) correlations for EABR & ESRT thresholds versus Comfort Levels were calculated over time. These were used to derive predictive formulae by linear & multiple regression analysis. Such statistically predicted Comfort Levels were compared with behaviourally recorded Comfort Levels among cohorts, using Cronbach’s Alpha Reliability test method for confirming the efficacy of this method.

**Results:** ECAP, ESRT & EABR thresholds showed statistically significant positive correlations with behavioural Comfort Levels, which improved with implant use over time. These correlations were used to derive predicted Comfort Levels using regression analysis. Such predicted Comfort Levels were found to be in proximity to the actual behavioural Comfort Levels recorded among the cohorts and proved to be statistically reliable. When clinically applied, this method was found to be successful among subjects of the study group. Although there existed disparities of a few clinical units, between actual & predicted Comfort Levels among the subjects, this statistical method was able to provide a working MAP, close to the behavioural MAP used by these children. The results help to infer that behavioural measurements remain mandatory to program cochlear
implantees, but in cases where they are difficult to obtain, this study method may be used as reference for creating an optimal MAP, which may be fine-tuned later with behavioural inputs over a time of implant use.

**Conclusion:** The study explores the trends & correlations between electrophysiological tests & behavioural responses, recorded over time among cohorts of cochlear implantees and provides a statistical method which may be used as a guideline to predict optimal behavioural levels in difficult situations among future implantees. In ‘Difficult to MAP’ scenarios, following such a protocol of sequential behavioural programming, in conjunction with electrophysiological correlates will provide the best outcomes.