Speech Perception, Production and Language Results
In A Group Of Children
Using The 22-Electrode Cochlear Implant.

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1: The Melbourne Program's Structure.

After a child is considered suitable for implantation, he/she enters a pre-operative program
which lasts for a minimum period of three months. The program includes counselling of parents,
liason with teachers at the child’s educational setting, weekly training in speech production,
language and speech perception and baseline assessments in these three areas. The child continues
to receive approximately one to two hours of training weekly during the post-operative period.
Regular assessments are conducted to determine the long-term benefits of habilitation with the
implant.

2: Type of Evaluations.

There are evaluations in speech perception, speech production and language. The choice of
tests is dependent on the child’s age, language and cognitive skills. Perception tests include open-set
word and sentence tests as well as closed-set word tests. Speech production tests include articulation
of consonants and vowels and the intelligibility of running speech. Language tests include elicited
receptive and expressive assessments and spontaneous language samples.
3: Children’s Results.

20 children have been implanted in Melbourne to date. Formal results have been collected over time for nine children. Of the 11 children who have not been assessed over time, seven were only recently implanted and four have insufficient language skills for testing. Three distinct groups emerge for the nine children with long-term data.

(Group 1a) - is characterized by a younger age at implantation and a shorter duration of profound deafness.

(Group 1b) - is characterized by a shorter duration of profound deafness but an older age at implantation.

(Group 2) - is characterized by a greater duration of profound deafness and an older age at implantation.

The children in groups 1a and 1b (n=5) achieve some open-set speech recognition through hearing alone.

4: Patient Details for the five children who show open-set speech recognition through hearing alone.

Four of the children were deafened after birth and each of the children are in educational programs which emphasize auditory/oral skills. Two of the children receive a cueing supplement. Given time restraints a cross-section of results from the 3 areas of assessment; speech perception, speech production and language will be presented. Detailed results have been submitted to J.S.H.R.

CHILD 5 had reasonable speech and language at the time of implantation and was trained and assessed in speech perception only.
5: Open-set Results Hearing Alone.

This slide shows open-set percentage scores on word and sentence level tests presented hearing alone. The word test was scored phonemically. These results were obtained at varying stages in the post-operative period; at 46 mths, 26 mths, 8 mths, 11 mths and 15 mths for CHILDREN 1,2,3,4 and 5 respectively. The sentence test was not administered to CHILDREN 1 and 4 who thought the task was too difficult and were reluctant to attempt it. The phoneme score for CHILD 1 needs to be treated with some caution. This child asked for a repeat on six of the 20 items in the test.

6: Closed-set Speech Perception Results.

Several closed-set speech perception tests were administered at regular intervals to monitor changes over time. Slide 6 shows the results for one of these tests, the Northwestern University Children's Perception of Speech (NU-CHIPS) test which many of you would be familiar with (Elliott and Katz, 1980). It is a 4 alternative forced-choice task with 50 monosyllabic words. Discriminations of consonant manner and place of articulation are generally required in this test. The closed circles represent pre-operative scores and open circles post-operative scores. Children 1 and 2 showed significant changes in proportional scores over time at the 5% level of significance (using Chi-square statistical analysis). Visual inspection of the results indicate that post-operative scores exceeded pre-operative scores and that scores improved over the post-operative test intervals. Child 3 showed a significant change in scores at the 1% level of significance. Child 5 was tested only once on this test at 14 months post-operatively and obtained the excellent score of 90%.
7: The Implant Supplements Lipreading.

This slide shows results for BKB sentences tested in the vision alone mode (V) versus the combined mode with audition plus vision (AV) (Bench and Bamford, 1979). The final post-operative scores are shown and compared to final pre-operative scores where possible. The AV score was significantly better than the V score in the post-operative testing for children 1, 2, 3 and 5. The AV score was not significantly better than the V score in any of the pre-operative testing.

8: Speech Production Improves Over Time.

Each of the children received an appropriate articulation test; two children had the Fisher-Logemann test (Fisher and Logemann, 1971) and two had the Edinburgh Articulation Test (Anthony et al, 1971). All showed a significant change in scores over time (indicated by Chi-square analysis) and one can see that the scores are improving from the pre-operative to the post-operative period. For a few of the children there is an initial drop in scores soon after the operation. This is not unexpected given the trauma of the operation and the time taken to tune the device appropriately. The intelligibility of the children's running speech was also measured using McGarr sentences (McGarr, 1983). In only one child did scores improve significantly over time.
9: Language Improves Over Time.

There have also been some encouraging improvements in language over time. As with the speech production results however, one cannot separate out the effects of training and the effects of the device. This slide shows results on a test of receptive vocabulary, the Peabody Picture Vocabulary Test - Revised (PPVT-R) (Dunn and Dunn, 1981). Performance is measured in terms of equivalent age; i.e., the age of a normally hearing child who receives the same score as the deaf child. It can be seen that Child 2's performance at 5.6 yrs of age was equivalent to that of a 2 yr old normally hearing child. Approximately two years later however, the child has caught up considerably, with receptive vocabulary equivalent to that of a 5 yr old normally hearing child. A linear regression or correlational analysis was conducted and the asterisks indicate significantly positive slopes. The b value refers to the degree of improvement over time (the coefficient of the regression slope). If b is > 1.0, this indicates that the deaf child is improving at a faster rate than that expected for a normally hearing child.

Overall the receptive language results for these children on tests of vocabulary and syntax, were better than the expressive language results. This is understandable in light of evidence that expressive skills develop more slowly than receptive skills.

10: Summary.

Results therefore indicate that five children out of nine tested over a long period of time, show some hearing alone speech recognition. Factors which may have contributed to the success of these five children in contrast to the four who do not demonstrate open-set speech recognition, are; (a) the duration of profound deafness and (b) memory for sound. Each of the five children had a shorter duration of deafness and four had some memory for sound. The children continued to show improvements over time in speech perception, speech production and in language.
Further studies on implanted children will help to clarify the importance of these factors and other factors in determining successful implant use for children.

References


