Effect of Bimodal Stimulation on Hearing and Speech Development in Children with Bilateral Severe/Profound Hearing Loss

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Newborn hearing screening program in China

- Implemented at Shanghai in 2002 and national generalized thereafter
- Early diagnosis and implantation could be achieved in most severe/profound hearing impairment children

診断和干预年龄

![Graph showing comparison between diagnosis and intervention with and without UHNS]
Three options so far in early intervention of severe-to-profound hearing impairment children

- Unilateral electrical stimulation (cochlear implantation)
- Bilateral electrical stimulation (cochlear implantation)
- Bimodal stimulation (Cochlear implantation + Hearing Aid)
Introduction

- Bimodal stimulation
  - CI in one side while conventional hearing aid in contralateral side

- Necessity and effect
  - To prevent auditory deprivation of the contralateral ear
  - Compare to CI only, bimodal stimulation can help CI recipients perceive speech and music better
  - To utilize the possible residual hearing of the contralateral side even without detectable ABR response in Children
The previous studies have indicated that bilateral CI has advantage over bimodal stimulation in case of bilateral severe-to-profound SNHL.

But in developing countries:
- Bilateral CI still difficult in most cases
  - ≈5% in China

Bimodal stimulation could be an alternative choice.
Objective

This study aimed to investigate the effect of bimodal stimulation on hearing and speech development in children with severe-to-profound hearing impairment.
Materials and Methods

- **Retrospective analysis**
  - **Bimodal group (CI+HA)**
    - \(n=20, \text{ age}=8-39\text{m}
    - Gender: male=11; female=9
  - **Control group (CI Only)**
    - \(n=10, \text{ age}=11-38\text{m}
    - Gender: male=7; female=3

- A severe/profound hearing loss was diagnosed with ABR, ASSR, OAE and behavior audiometry
- Normal cochlear and auditory nerve confirmed with CT and MRI
- Conventional hearing aid regularly
Materials and Methods

- All children were implanted before the age of 3
  - Mean implantation age
    - Bimodal group: 20m
    - Control group: 21m

- A standard mastoid-facial recess approach in all cases
  - round window
  - cochleaostomy
Materials and Methods

- Switch-on was performed at two weeks, one month, three months, six months and one year respectively.
- A conventional hearing aid was fitted in bimodal group after surgery.
- Four mandarin pediatric assessment materials were used including:
  - The Infant-Toddler Meaningful Auditory Integration Scale (IT-MAIS)
  - The Categories of Auditory Performance (CAP)
  - The Meaningful Use of Speech Scale (MUSS)
  - The Speech Intelligibility Rating (SIR)
Results

- All electrodes were fully inserted during surgery
- No intraoperative and postoperative complications
- All switched on one month after surgery with normal parameters
Results

The bimodal group (CI+HA)

The control group (CI only)
Results

The difference of IT-MAIS results were significant at 2 weeks, 1 month, 3 months, 6 months (p<0.05), whereas the difference of IT-MAIS results was not significant at 1 year (p>0.05)
Results

The bimodal group (CI+HA)  

The control group (CI only)
Results

The difference of CAP results were significant at 2 weeks, 1 month, 3 months, 6 months, 1year (p<0.05)
The difference of MUSS results was not significant (p>0.05)
Results

Regarding SIR, the results of 2 weeks, 1 month, 3 months after switch-on were not significant different (p>0.05), while there was significant difference of 6 months, 1 year results between two groups (p<0.05).
In all assessments, the average score in bimodal group was higher than the control group.
Discussion

- The significant difference of CAP in two groups indicates that the development of hearing ability with bimodal stimulation is better than CI only.
- There is no significant difference at 1 year follow-up with IT-MAIS because of ceiling effect of the assessment.
The MUSS and SIR rely on speech development and could be no significant difference in the early stage.
Conclusion

- Bimodal stimulation is beneficial in hearing and speech development in children with severe/profound hearing impairment in their early developmental stage after switch-on
Thank you for your attention