INTRODUCTION

As speech processing devices or coding strategies have progressed, speech perception in cochlear implant (CI) users has become significantly improved. Some CI users, however, use signs or lip reading to communicate with others because of the limited auditory information. Comparison between speech perception with and without lip reading will provide information on degree of visual dependence, but it is difficult to unify the test conditions. In Japanese, most syllables end with vowels and thus vowel perception is highly involved in speech intelligibility. We prepared vowel perception test to analyze the contribution of visual and auditory inputs during vowel processing in CI users. Results in normal hearing (NH) participants were also obtained and compared with those in CI users.

METHODS AND MATERIALS

Participants

- Adult CI cochlear implant users (n=38)
  - Age: 20 – 79y (58.1±15.2)
  - Duration of CI use: 4 – 170 m (45.0±38.7)
- Pediatric CI cochlear implant users (n=48)
  - Age: 5 – 23 y (9.3±3.3)
  - Duration of CI use: 12 – 120m (54.4±25.3)
- Normal hearing adults (n=10)
  - Age: 27 – 61 y (37.0±11.9)
- Normal hearing children (n=11)
  - Age: 7 – 12 y (9.5±1.6)

Stimuli

- Auditory stimuli: 5 Japanese vowels (/a/, /e/, /i/, /o/ and /u/) separately uttered by a female speaker
- Visual stimuli: 6 pictures of woman’s face (neutral lip form without any movement and 5 lip forms articulating Japanese vowels)

Test conditions

- Three test conditions were used (fig.1):
  1) AV: the matched pairs of visual and auditory stimuli
  2) AV-mismatch: the inconsistent pairs of stimuli
  3) A-only: neutral lip form and auditory stimuli

RESULTS

In adult CI group, strong correlation was found between the monosyllable test score and the correct rate in AV-mismatch condition (r=0.72) (fig.3a)). Also in pediatric CI group, correlation between the monosyllable score and the AV-mismatch score was found (r=0.41) (fig.3b). No correlation was found between AV-mismatch score and age or at CI or duration of CI use in both age groups.

Moreover, mode of communication during preschool period were considered in pediatric group. Pediatric CI users who scored above 50% in the monosyllable test were divided into two groups according to the communication mode. No significant difference of monosyllable test score was found between two groups, but the correct rate of AV-mismatch condition in those who have been using aural was significantly higher than in those who have been using total communication(fig.4).

CONCLUSIONS

The test we use in the current study was simple task even for children, and it could show numerically the degree of visual dependence. Processing of visual and auditory inputs in pediatric CI users was close to that of postlingually deafened adult CI users, but some children who have had been using total communication depended highly on visual information. This implies that processing of visual and auditory inputs in pediatric CI users was close to that of one who learned speech and language through the auditory modality. However, the degree of visual dependence of total group might be affected by the factors except for speech intelligibility.