Estimates of selective listening ability using otoacoustic emission measured by different awareness

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Otoacoustic emission is a phenomenon described by Kemp in 1978 in which weak sounds are radiated into the ear canal by the active function of the cochlea. Otoacoustic emissions are used in newborn hearing screening because it is a phenomenon that demonstrates the nonlinearity of the cochlea and can be detected regardless of the listener's intention in the measurement. On the other hand, problems in hearing everyday sounds can occur even if the hearing test shows normal hearing. An example of this is the inability to hear selectively. Selective hearing is the ability to listen selectively to the sounds one wants to hear by directing one's attention to the sounds one wants to hear in noisy situations. Even if newborns are screened for hearing problems, problems such as a lack of selective hearing may be found after growth. Children with problems such as selective hearing loss have difficulty learning, such as in high-noise classrooms, and may have delays in learning and speech production. It is important to take early interventions for such children, such as providing a quiet environment. Studies of auditory attention and otoacoustic emissions related to selective hearing have shown that attention can alter otoacoustic emissions. If the relationship between otoacoustic emissions and selective hearing can be clarified, selective hearing ability can be estimated from characteristic changes in otoacoustic emissions, and auditory information processing problems such as reduced selective hearing ability can be detected during newborn hearing screening.

In a study of auditory attention and otoacoustic emissions associated with selective auditory performance, we investigated whether centrifugal projection input to external hair cells contains the effects of attention and whether these effects are manifested in otoacoustic emissions. The results showed that changes in the peripheral auditory system induced by auditory attention are likely to be measured by measuring otoacoustic emissions. However, no characteristic changes in attention-related otoacoustic emissions were observed.

In a study investigating whether the function of centrifugal projection from the brainstem to the outer hair cells varied with awareness, an overwhelming positive correlation was found between alpha waves associated with awareness and centrifugal projection function in the EEG.

The reason that there were no characteristic changes in the attention-related otoacoustic emissions is probably because the listening experiment was conducted in a situation in which attention was always active, and attention was always directed to things that were not desired. In order to

imagine a situation in which attention-related changes in the properties of the otoacoustic emissions are observed and thus affect selective listening performance, it is necessary to compare the changes in the properties of the otoacoustic emissions in different awareness states.

The novelty of this study is that it focuses on the changes in otoacoustic emissions at different awareness to assess the ability of selective hearing using otoacoustic emissions. Listening experiments are conducted to investigate the relationship between the feature changes of otoacoustic emissions at different awareness and the ability of selective hearing during wakefulness. The significance of this study is to clarify the features of otoacoustic emissions corresponding to selective hearing at different awareness. This suggests that focusing on arousal level in the study of auditory attention related to selective listening may provide characteristic changes in otoacoustic emissions that are directly related to attention.

The aim of this study was to measure selective hearing ability as a function of different awareness and attention levels in relation to otoacoustic emissions and to clarify whether it is possible to assess selective hearing ability based on changes in otoacoustic emissions. A two-task experiment was conducted to measure selective hearing ability during wakefulness The first task consisted of listening to target speech words from a mixed speech of several speakers (auditory figure-ground task). The second task consisted of hearing separate target sounds presented to each ear (competing word task). Transitory evoked otoacoustic emission was measured in the awake/sleep condition to investigate the relationship between otoacoustic emissions at different awareness and selective auditory performance.

The results showed that in the auditory figure-ground task, there was a tendency for the correct response rate to increase in response measured otoacoustic emissions in the right ear during the awake condition. In the left ear, the percentage of correct responses tended to decrease in response to the measurements of otoacoustic emissions in the awake/sleep condition. In the competing word task, there was a tendency for the correct response rate to increase in response to the otoacoustic emissions measurements in both the awake and sleep. These results suggest that there is a relationship between selective hearing ability and the intensity of otoacoustic emissions and that otoacoustic emissions can be used to assess selective hearing ability. In addition, measurements of otoacoustic emissions during sleep were predominantly lower than those of otoacoustic emissions during wakefulness, suggesting that otoacoustic emissions also decrease as awareness decreases. This implies that the awareness can be estimated from the otoacoustic emissions.