Wideband frequency impedance for diagnosis of ossicular chain abnormality

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Abstract

Aims/Objectives: This study aimed to verify the accuracy of preoperative diagnosis of ossicular chain abnormalities using a wideband frequency impedance (WFI) meter.
Material and Methods: Retrospective cohort study. Fourteen ears of patients with ossicular chain abnormalities.
Results: The distribution map revealed that the ossicular chain separation range and ossicular chain fixation range were completely separated.
Conclusions : WFI can be used for the classification of ossicular chain separation and fixation.

Objectifs

This study aimed to verify the accuracy of preoperative diagnosis of ossicular chain abnormalities using a wideband frequency impedance (WFI) meter, which can measure the dynamic characteristics of the middle ear.

Méthodes et Matériels

Retrospective cohort study. Fourteen ears of patients with ossicular chain abnormalities that were definitively diagnosed surgically were included in this study. The following data were collected for each participant: sound pressure level (SPL) curve measured using the WFI meter and a sweep frequency impedance (SFI) meter, WFI measurements plotted on the resonance frequency (RF)-ΔSPL plane, distribution map of the dynamic characteristics of the middle ear, and the definitive surgical diagnosis.
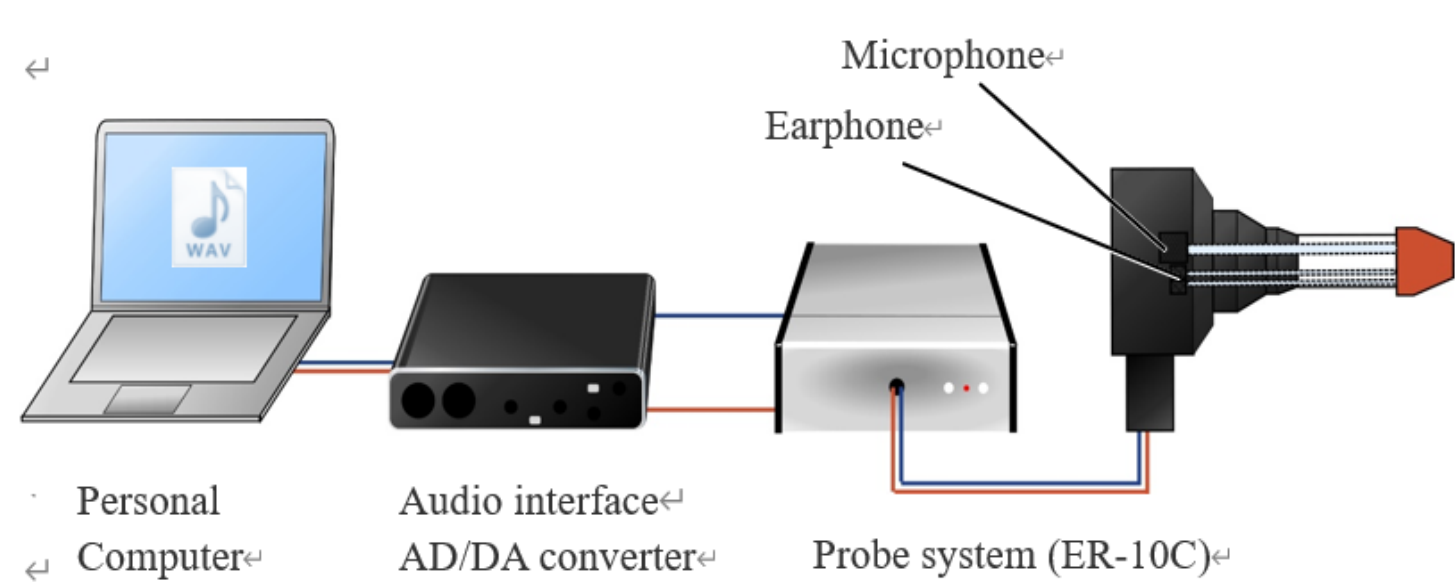

Fig 1: A schematic diagram of the WFI meter. The WFI meter consists of a personal computer, a USB audio interface, and a probe system containing two earphones and a microphone, and an amplifier.
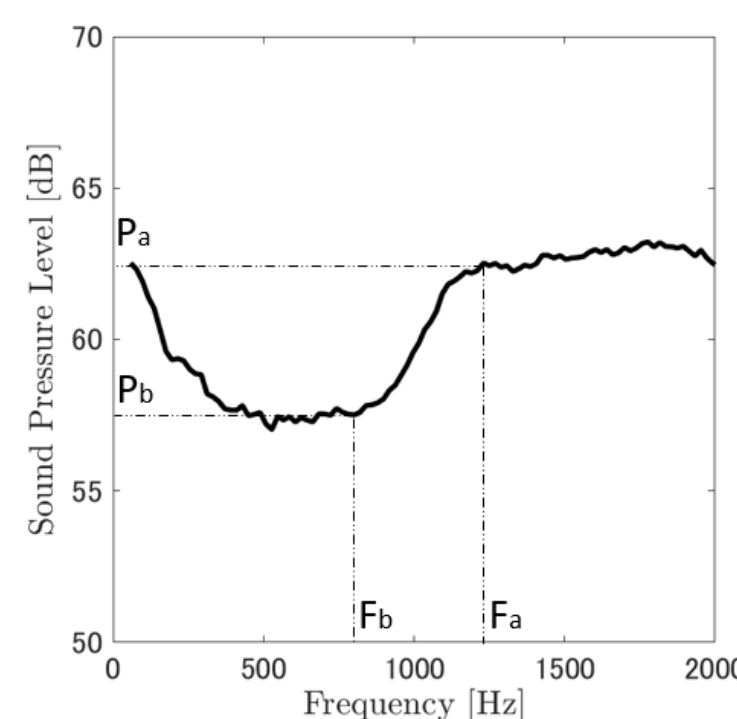

Fig2 SPL curve of an adult with normal hearing measured using WFI.

P_a and P_b Maximum and minimum sound pressures
F_a and F_b Frequencies corresponding to the maximum and minimum sound pressures
RF and ΔSPL Defined by $(F_a + F_b)/2$ and $P_a - P_b$, respectively (1).

Résultats

Measurement data of WFI

Figure 3A shows the distribution of RF and the ΔSPL value of each group. The confidence intervals at the 0.95 level for RF and the ΔSPL value are enclosed with spline curves to create a clear distribution map (Fig. 3B).
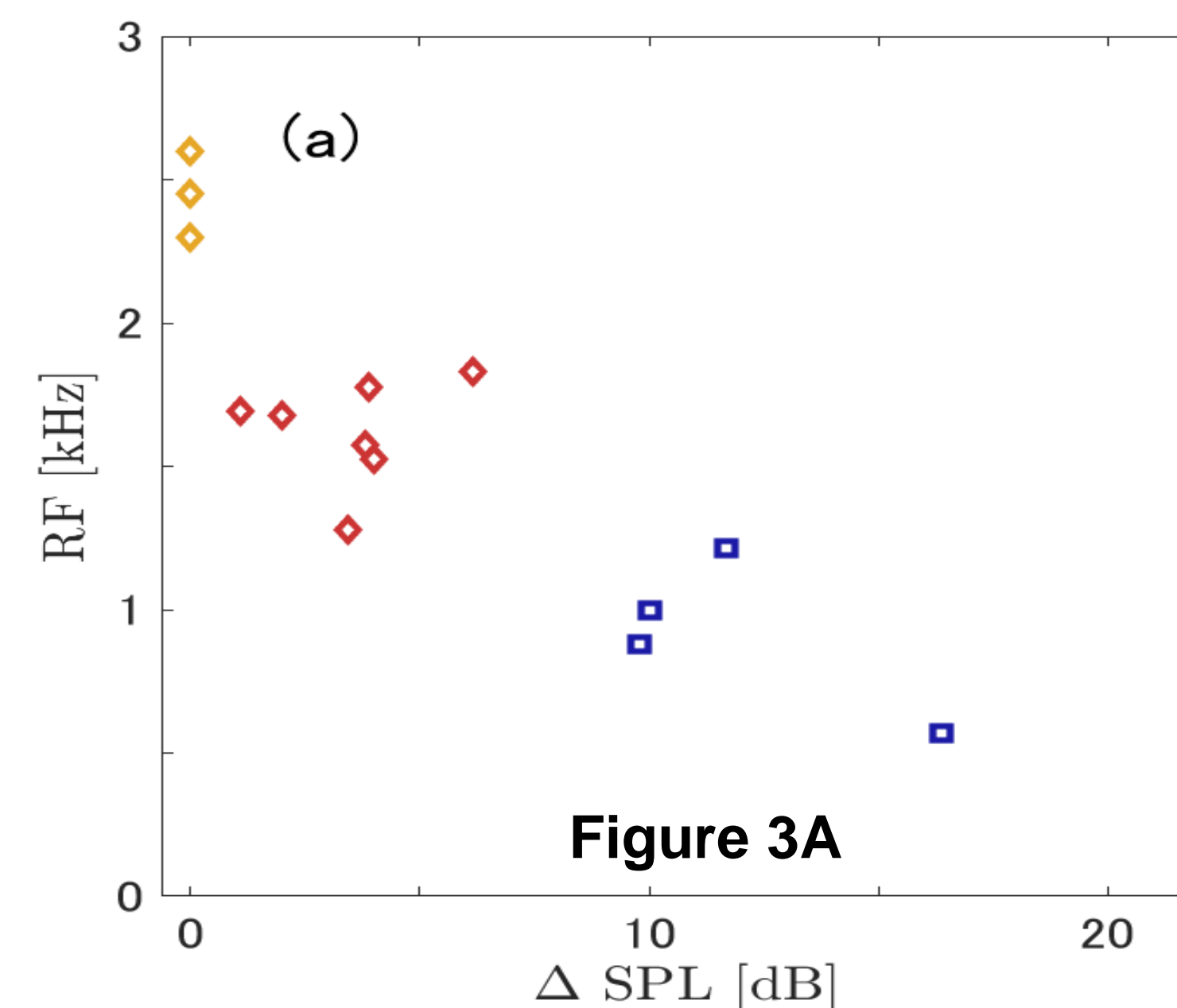

Figure 3A

Fig 3A: Distribution of the RF and the value of the ΔSPL for each group. Yellow diamond: range over. Red diamond: Fixation. Blue square: Separation.
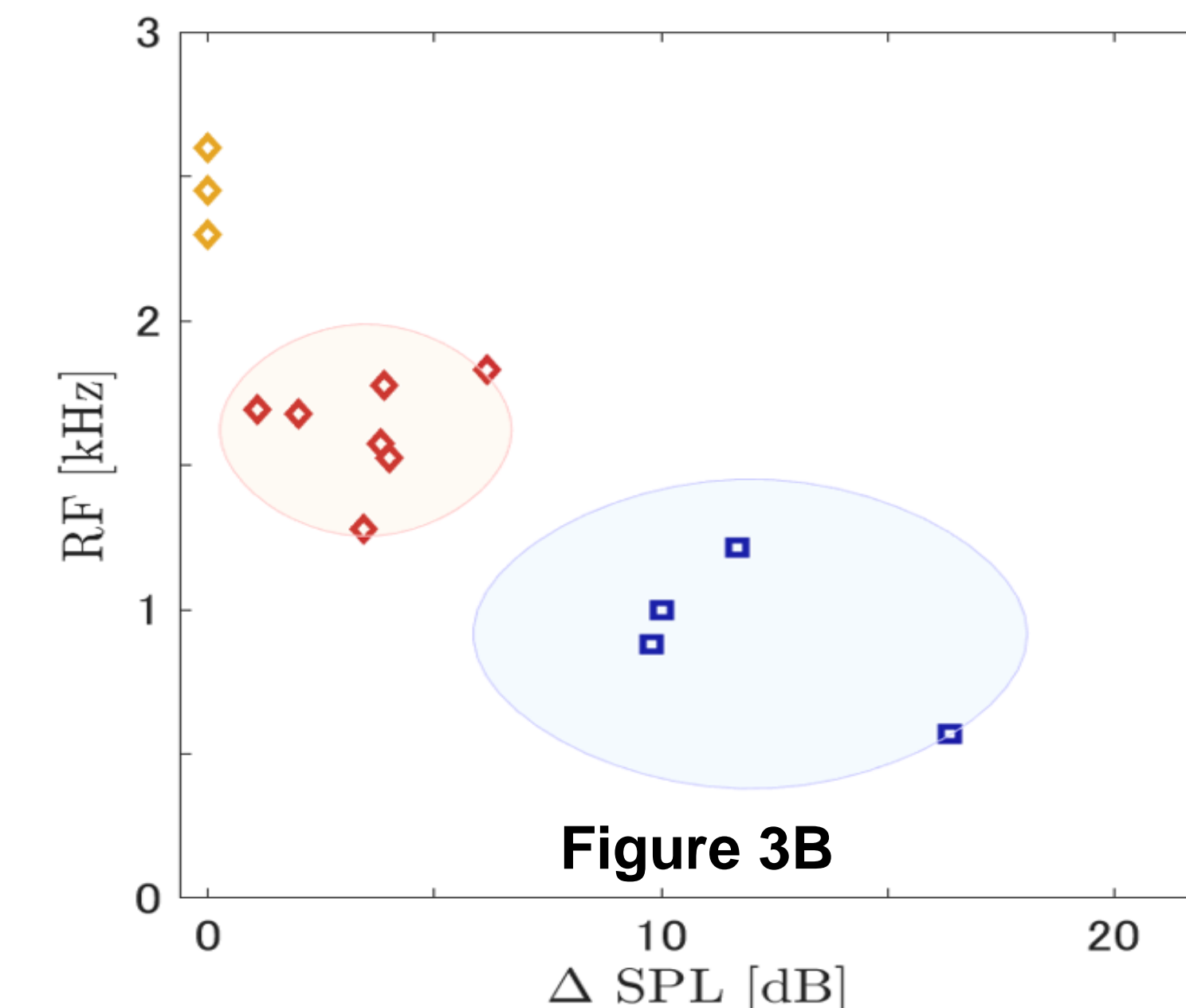

Figure 3B

Fig3B: The confidence intervals at the 0.95 level for the resonance frequency and the value of the ΔSPL are enclosed with spline curves to create s clear distribution map. Red circle: Fixation area, Blue circle: Separation area.

Conclusion

Our results suggest that the WFI meter may be capable of classifying fixation and separation in patients with ossicular chain anomalies. The number of cases should be increased in future studies to improve data accuracy. We aim to conduct a multicenter, joint study in the future.

Références

(1) Wada H Kobayashi T. Dynamical behavior of middle ear: theoretical study corresponding to measurement results obtained by a newly developed measuring apparatus. J Acoust Soc Am 1990; 87: 237-45.