

# Establish the Diagnostic Criteria of Impedance Test of Patients with Chronic Eustachian-tube Dysfunction in Taiwan

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## Introduction

The Eustachian tube (ET) connects the middle ear to the nasopharynx and is essential for maintaining middle ear pressure balance. ET dysfunction (ETD) can cause aural fullness, fluctuating hearing, and may contribute to chronic otitis media or cholesteatoma. However, standardized criteria for objective ET function assessment are lacking in Taiwan.

This study compares impedance test results between ETD patients and healthy controls using the GSI Tymptstar Pro system and aims to establish normative values for the Taiwanese population.

## Method

Study period: May 26, 2023 – October 29, 2024

### Participants

- Healthy control Group (n=100): No ear/sinus disease; ETDQ-7 score <14.
- ETD Group (n=52): ETDQ-7 score  $\geq 14$ ; abnormal tympanogram (Type B or C); physician-confirmed symptoms.
- Exclusion Criteria: Age <18; perforated eardrum; tubes; acute ear infections; recent ear surgery; or inability to complete the test.

### Procedures

- Tympanometry: Middle ear pressure was measured using the GSI Tymptstar Pro system before and after a swallowing maneuver.
- Symptom Assessment: The ETDQ-7 questionnaire was administered to all participants to evaluate Eustachian tube dysfunction symptoms.

### Statistical Analysis

- Group Comparisons: Mann-Whitney U test (for age and test results) and Chi-square test (for sex distribution) were used to compare the two groups.
- Diagnostic Accuracy: ROC curve analysis determined the optimal diagnostic cutoff, with AUC and Youden's index used as measures of accuracy.

## Conclusion

A pressure change  $\leq 4$  daPa following a swallow maneuver is a valid indicator for ETD diagnosis in the Taiwanese population. When combined with ETDQ-7, it provides an effective tool for clinical diagnosis and post-treatment follow-up.

## References

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## Results

Our study findings revealed significant differences between the ETD and control groups in both tympanometry results and questionnaire scores, highlighting the diagnostic potential of our approach.

### Participant Characteristics

Variable	Controls (n=100)	ETD (n=52)	p-value
Age (years, mean)	36.0	52.1	<0.001
Gender (M/F)	53/47	23/29	0.305 (ns)

Table 1. Participant Demographics and Group Comparison

### Tympanometry and Symptom Scores

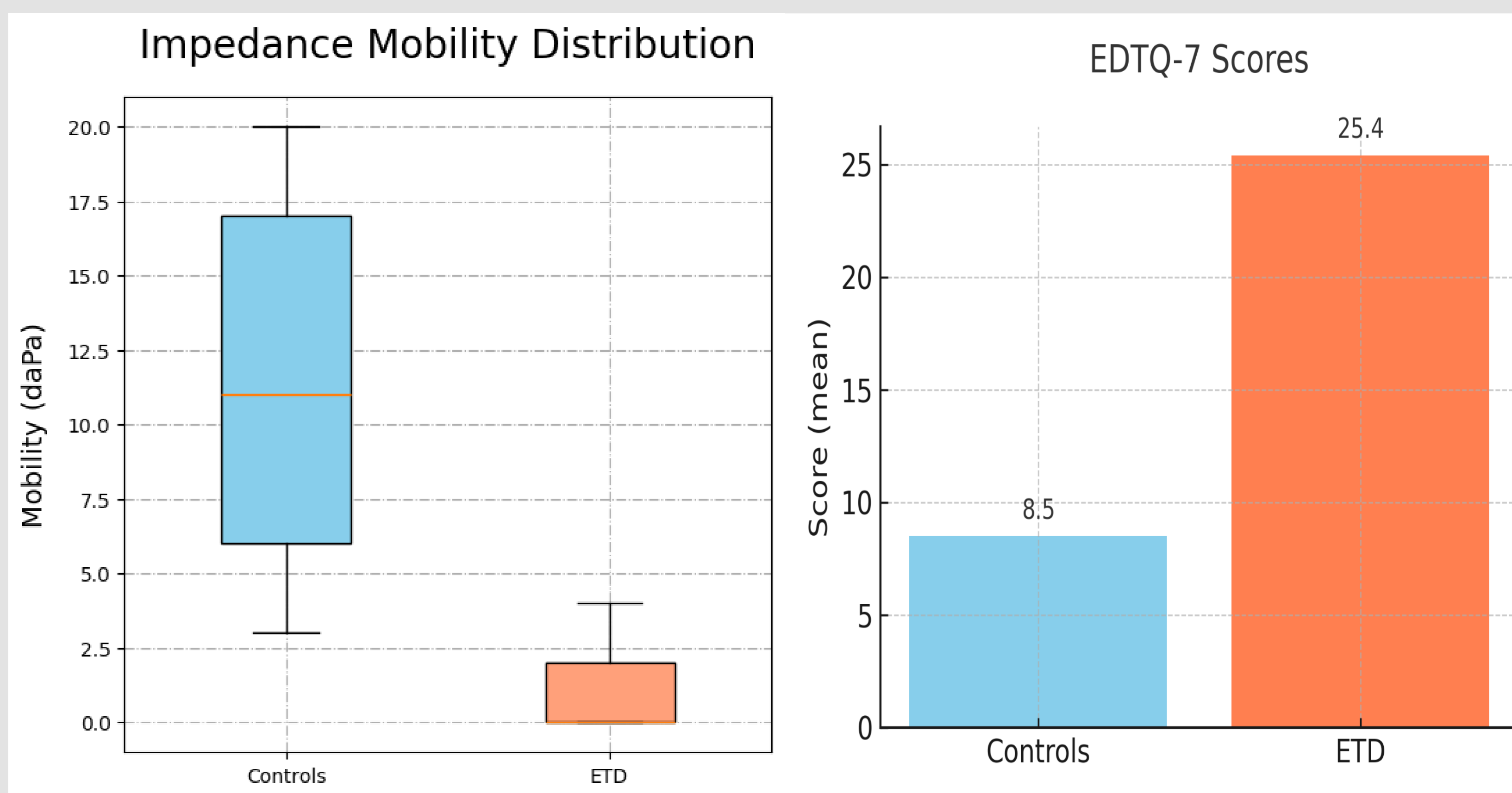


Figure 1. Tympanometry and Questionnaire Results. Both scores showed highly significant differences between groups ( $p < 0.001$ ).

### Diagnostic Accuracy

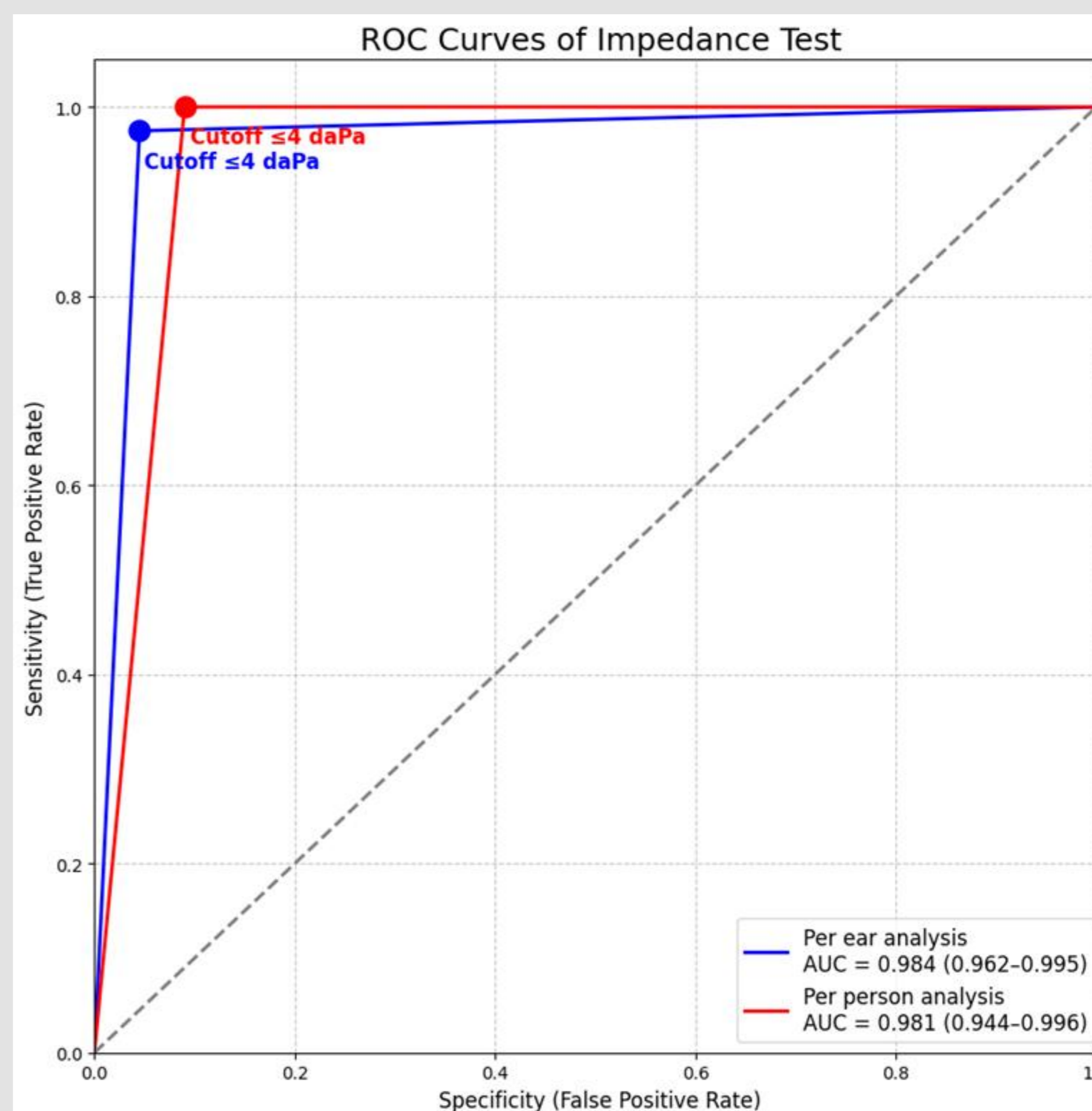


Figure 2. Diagnostic Accuracy Using ROC Curve Analysis

Analysis	Sample size	Cutoff	Sensitivity	Specificity	AUC (95% CI)	Youden's Index
Per person	ETD group=52 Controls group=100	$\leq 4$ daPa	100%	91%	0.981 (0.944-0.996)	0.910
Per ear	ETD group=79 Controls group=200	$\leq 4$ daPa	97.47%	95.5%	0.984 (0.962-0.995)	0.930

Table 2. Diagnostic Performance of the Variable Impedance Test (Per Person and Per Ear Analysis)

Our analysis identified a pressure change cutoff of  $\leq 4$  daPa as a highly accurate diagnostic marker. The Area Under the Curve (AUC) was excellent for both per person analysis (AUC = 0.981) and per ear analysis (AUC = 0.984), confirming the diagnostic utility of this method.