



ORIGINAL ARTICLE

Contralateral Occlusion Test: The effect of external ear canal occlusion on hearing thresholds

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KEYWORDS

Hearing loss;
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Occlusion;
Hearing tests;
Bedside testing;
Auditory threshold

Abstract

Introduction and goals: Bedside testing with tuning forks may decrease turnaround time and improve decision making for a quick qualitative assessment of hearing loss. The purpose of this study was to quantify the effects of ear canal occlusion on hearing, in order to decide which tuning fork frequency is more appropriate to use for quantifying hearing loss with the Contralateral Occlusion Test.

Methods: Twenty normal-hearing adults (forty ears) underwent sound field pure tone audiometry with and without ear canal occlusion. Each ear was tested with the standard frequencies. The contralateral ear was suppressed with by masking. Ear occlusion was performed by two examiners.

Results: Participants aged between 21 and 30 years (25.6 ± 3.03 years) showed an increase in hearing thresholds with increasing frequencies from 19.94 dB (250 Hz) to 39.25 dB (2000 Hz). The threshold difference between occluded and unoccluded conditions was statistically significant and increased from 10.69 dB (250 Hz) to 32.12 dB (2000 Hz). There were no statistically significant differences according to gender or between the examiners.

Conclusion: The occlusion effect increased the hearing thresholds and became more evident with higher frequencies. The occlusion method as performed demonstrated reproducibility. In the Contralateral Occlusion Test, 256 Hz or 512 Hz tuning forks should be used for diagnosis of mild hearing loss, and a 2048 Hz tuning fork should be used for moderate hearing loss.

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Abbreviations: COT, Contralateral Occlusion Test; EEC, external ear canal; ISO, International Organization for Standardization; LE, left ear; RE, right ear.

Abreviaturas: COT, prueba de oclusión contralateral; EEC, conducto auditivo externo; ISO, Organización Internacional para Estandarización; LE, oído izquierdo; RE, oído derecho.

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PALABRAS CLAVE

Hipoacusia;
Conductivo;
Audiometría;
Conducto auditivo;
Oclusión;
Pruebas auditivas;
Pruebas de cabecera;
Umbral auditivo

Prueba de oclusión contralateral: efecto de la oclusión del conducto auditivo externo sobre los umbrales auditivos

Resumen

Introducción y objetivo: Las pruebas de cabecera realizadas con diapasón pueden reducir el tiempo de respuesta y mejorar la toma de decisiones en la evaluación rápida cualitativa de la hipoacusia. El objetivo de este estudio fue cuantificar los efectos de la oclusión del canal auditivo sobre la audición, a fin de decidir qué frecuencia de diapasón es más adecuado utilizar para cuantificar la hipoacusia con la prueba de oclusión contralateral.

Métodos: Veinte adultos con audición normal (40 oídos) fueron sometidos a una audiometría de tonos puros, con y sin oclusión del conducto auditivo. Se realizó una prueba en cada oído, a las frecuencias estándar. El oído contralateral fue suprimido mediante enmascaramiento. La oclusión del oído fue realizada por parte de 2 examinadores.

Resultados: Los participantes de edades comprendidas entre 21 y 30 años ($25,6 \pm 3,03$ años) reflejaron un incremento de los umbrales auditivos con frecuencias ascendentes de 19,94 dB (250 Hz) a 39,25 dB (2.000 Hz). La diferencia de dicho umbral entre las situaciones de oclusión y no oclusión fue estadísticamente significativa, incrementándose de 10,69 dB (250 Hz) a 32,12 dB (2.000 Hz). No se produjeron diferencias estadísticamente significativas con arreglo al sexo, o entre los examinadores.

Conclusión: El efecto de la oclusión incrementó los umbrales auditivos, siendo este hecho más evidente con frecuencias más elevadas. El método de oclusión realizado demostró la reproducibilidad. En la prueba de oclusión contralateral deberán utilizarse diapasones de 256 o 512 Hz para el diagnóstico de la hipoacusia leve, y un diapasón de 2.048 Hz para la hipoacusia moderada.

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Introduction

Bedside testing, otherwise referred to as near-patient or point-of-care testing, is not new and remains an integral part of clinical practice.^{1,2} Many of the early diagnostic tests are initially performed at the bedside; this practice may decrease turnaround time, reduce costs, and improve decision making.³ The key objective of bedside testing is to generate a quick result, so that appropriate treatment can be implemented, leading to an improved clinical and economic outcome.³⁻⁵

Tuning fork testing allows a quick, qualitative assessment of hearing and also allows for the distinction between conductive and sensorineural hearing loss.⁶⁻⁸ The evaluation of patients with unilateral hearing loss can be quickly evaluated with Weber, Rinne and other tuning fork tests.^{7,9-13} However, none of these tests really permits a quantitative hearing assessment.

The authors of this paper designed a bedside test that could permit the quantitative evaluation of hearing loss in the presence of unilateral conductive hearing loss. After the confirmation of unilateral conductive hearing loss with Weber and Rinne tests, the Contralateral Occlusion Test (COT) is carried out with total occlusion of the external ear canal (EEC) of the contralateral ear (the non-affected ear). This will produce a hearing loss on the non-affected ear that can be higher, lower, or similar to the affected ear. In this scenario, the sound of a vibrating tuning fork placed in the middle of the forehead will lateralize to the ear with the greater hearing loss.

It is very important to quantify and standardize the effects of EEC occlusion on hearing in order to decide which tuning fork frequency is more appropriate for quantifying the loss. EEC occlusion in COT is a simple, inexpensive, reproducible, and non-invasive method. EEC occlusion is a common situation in daily life; it is significant because of the modifications that it may cause to hearing, through interference in the variability of bone and air conduction. It can occur in various physiological or pathological conditions, including the presence of cerumen, exostosis, or an occlusion caused by the hearing aid mold.¹⁴⁻¹⁹ Despite the frequency of ear canal occlusion in daily life, studies about this effect on hearing thresholds have not been found in the literature. There are only two studies dealing with occlusion of the external auditory canal.^{20,21}

The aim of the study was to measure the effects of complete occlusion of the EEC phenomenon on hearing thresholds and to evaluate the reproducibility of the method (among each examiner) in order to apply it in the COT in normal-hearing young adults. Depending on the loss induced by this effect, we also aimed to decide the best frequency for the tuning fork in order to distinguish between mild and moderate conductive hearing loss.

Methods

Participants

The protocol for this study was evaluated and approved by the Health Ethics Committee (CES) of the *Centro Hospitalar*

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