Video-Otoscopy

Background and Statement of the Problem

The Department of Defense Hearing Conservation Program by regulation requires all active duty service members to have an annual audiological evaluation. Service members identified with a significant threshold shift are required to have a follow-up examination with a physician to eliminate pathology as the causative agent for the hearing loss. While compliance with the annual hearing evaluation is high, there is a poor record for the required follow-up with a physician. It is estimated that only 5% of patients identified with a hearing loss receive the DOD mandated follow-up.

There are a number of reasons for this lack of compliance: (1) a visit to a clinic removes the service member from his/her job which is disruptive to team training and coordination, (2) the service member may fear that a hearing loss will lead to a medical discharge from the military, and (3) the physician does not view significant thresholds shifts as critical, because they are largely the result of noise, not pathology, and cannot be treated medically.

Research Questions and Hypotheses

a. Does a difference exist between otological evaluations using a hand-held otoscope, a binocular microscope, and a video-otoscope?
b. What are the clinical protocols for the use of video-otoscopy?
c. What are the training requirements for capturing video images?
d. Can analysis of digital images of the tympanic membrane improve diagnosis of ear disease over current methods?

Project Description (proposed solution)

In order to improve compliance for the follow-up otologic examination, a system of electronic triage has been proposed in which video images of the tympanic membrane will be captured at the time of the audiological examination. These video images can be evaluated off-line by an otolaryngologist. The initial phase of the project will establish the comparability of physical examinations using either hand-held otoscopes or binocular microscopes to the off-line evaluations of images captured with a video-otoscope. Once the reliability and validity of video-otoscopy has been established, video-otoscopes will be deployed to remote sites on Oahu, specifically, Hickam Air Force Base, Pearl Harbor, and Schofield Barracks, and Georgetown University School of Medicine. Data will be collected from these sites to be used in developing clinical protocols and training courses for the use of video-otoscopy. This data will also be used to support the inclusion of video-otoscopy for follow-up otological evaluations into the DOD regulations governing hearing conservation. Video-otoscopic equipment will be installed at USACHPPM to facilitate the incorporation of video-otoscopic images into hearing conservation software. Additionally, projects will be implemented to develop methods to exploit the digital technology used to capture video images in order to increase the accuracy of video-otoscopy over current practice for the diagnosis of ear disease.

Proposed Project Timeline

a. Site visit by COL Richard Dennis, OTSG Consultant in Audiology, Dr. Doug Ohlin, Chief, Bioacoustics, USACHHPM and Chair, Tri-Service Working Group in Hearing Conservation, and Dr. Thomas Hefler, USACHHPM, to review video-otoscopy project and discuss incorporation of video-otoscopy into the DOD regulations governing hearing conservation (April 1999).
b. Submit video-otoscopy to the Office of the Surgeon General as an item of interest for end-of-year funding (June 1999).
c. Complete data analysis comparing ratings of characteristics observed with hand-held otoscope and microscope to ratings on the video images by May 1999.
d. Submit paper on comparative study of hand-held otoscopy, microscopy, and video-otoscopy to referred journal (July 1999).
e. Revise and publish paper entitled "Telemedicine Applications in Hearing Conservation" in the Journal of Occupational Hearing Loss (in press) by April 1999.
f. Initiate development of computer algorithms for the analysis of digital images of the tympanic membrane by August 1999.
g. Install video-otoscopic equipment at USACHPPM and Georgetown University School of Medicine by October 1999.
h. Continue data collection from remote sites through September 2000.
i. Draft of clinical protocols to USACHPPM for integration into hearing conservation regulations by June 2000.

Performance Objectives/Deliverables

a. Establish the feasibility and validity of video-otoscopy for electronic triage of patients for follow-up otological evaluations.
b. Establish the knowledge base to allow for the widespread adoption of video-otoscopy.
c. Establish the clinical protocols for video-otoscopic evaluations.
d. Establish the training criteria for use of video-otoscopy.
e. Develop a regional video-otoscopy network to conduct remote evaluation of patients by specialists.
f. Consult with appropriate DOD representatives to establish appropriate clinical protocols for the incorporation of video-otoscopy into DOD regulations governing hearing conservation.
g. Conduct formal handoff of technical specifications and clinical protocols to the TriCare management agency and OSD/HA for integration into the DOD Health Care Hearing Conservation Program.
h. Develop methods of digital analysis of video images of the tympanic membrane to improve diagnosis of ear disease.