



## External Otitis and Hearing Protector Hygiene

By Elliott Berger, MS INCE, Bd. Cert.  
Representative for the American Industrial Hygiene Association  
(with abstracting and editing by Paul Brownson, MD FACOEM FAAFP, Representative for the American College of Occupational and Environmental Medicine)

### Basic Anatomy

The external ear consists of the auricle (pinna), the external auditory meatus (earcanal), and the tympanic membrane (eardrum) as illustrated in Figure 1. The pinna is

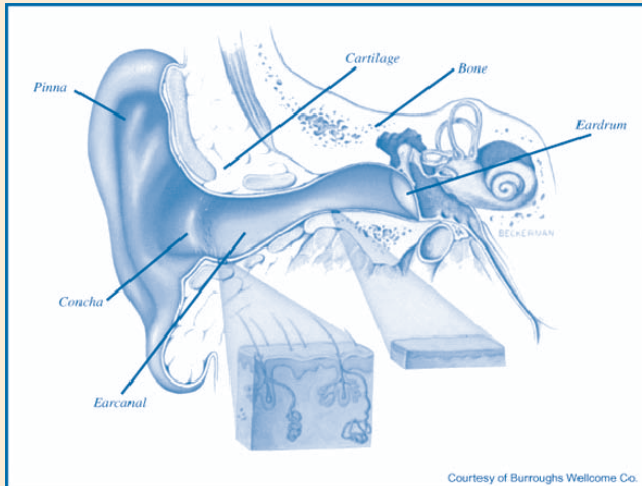


Figure 1 – Cross section of the ear canal with expanded views of the skin of the outer (cartilaginous) and inner (bony) portions of the ear canal.

a cartilaginous shell-shaped structure attached to the skull by muscles and ligaments that are covered by skin. The earcanal is a generally elliptical S-shaped tube, approximately 25-mm (1 inch) long, with an average diameter of 8 mm at its entrance. It is directed inward, upward, and slightly forward. The eardrum, which terminates the earcanal, forms an airtight and watertight barrier separating the middle ear from the external ear.

The outer half of the earcanal is cartilaginous, with an epithelial layer (skin) possessing numerous hair follicles and associated ceruminous and sebaceous glands. By contrast, the inner or medial half of the canal is osseous (bony), with skin that is only about 1/5 as thick (0.2 mm) and nearly devoid of hair follicles and glands. The differences between

the outer and inner portions of the earcanal in terms of pore structure and hairiness are similar to those found between the back of the hand and the palm.

The secretions of the ceruminous and sebaceous glands, together with dead skin cells which are regularly cast off and replaced, combine to form cerumen (ear wax), a water-repellent substance that coats and impregnates the skin of the earcanal. This coating is one of the most important protective mechanisms of the ear. It acts as a mechanical barrier that shields the skin from exposure to excessive moisture, and its acidity provides an antibacterial “acid cloak” that some believe inhibits the development of many of the bacteria responsible for earcanal infections.

Since the skin that lines the inner portion of the canal is continuous with the external layer of the eardrum, the earcanal can be thought of as a skin-lined tube. This “lining” migrates outwards from the center of the eardrum towards the entrance of the earcanal at the rate of about 1.5 mm/month. Skin migration, combined with jaw movement work to keep the canal clear of excess cerumen and other debris.

### What is an External Ear Infection?

The medical term that describes an inflammatory condition of any portion of the skin of the earcanal is otitis externa. This need not necessarily be an infectious process, i.e. one involving an invasion of the body by microorganisms. The inflammation may be caused by mechanical means (scratching) or chemical (caustic or allergenic) substances, or by biologic (bacterial and fungal) agents. Once the skin has been abraded or inflamed it is easier for microorganisms to become implanted in the follicles and glands of the earcanal and for an infection to develop. Since the hair follicles and glands are almost exclusively found in the outer third of the earcanal, infections are also primarily limited to that region.

*continued on page 5*



## OHC Spotlight

The “OHC Spotlight” focuses attention on Janet Weaver, an occupational health nurse at a major technology center in Texas.

Janet has been in occupational nursing for about 30 years and has been CAOHC certified and working in occupational hearing conservation for the past 20 years. She enjoys her work in the occupational setting because she is able to impact the health,

quality of life, and hearing of workers by ensuring that they wear the correct hearing protection and that they wear it properly both at work and at home. By speaking periodically with employees, Janet is able to understand their noise exposure and work cooperatively with the industrial hygiene function at her facility to ensure that all noise sources are properly evaluated. She likes cooking and spending time with her family on the weekends.

## External Otitis . . . – continued from page 3

It is important to distinguish soreness or irritation from the above conditions. For example, irritation may develop when a new user begins wearing hearing protection devices (HPDs) for extended periods of time. (For this reason new users should gradually increase their wearing time over a period of a couple of weeks). This type of irritation is similar to the discomfort many people experience on the bridge of the nose when they initially begin wearing glasses. The irritation will subside without treatment when either the irritant is removed, or the skin has adapted to its presence. In contrast, the resolution of earcanal infections generally requires medical treatment.

### Signs and Symptoms of Otitis Externa

Observable signs of infectious otitis externa include swelling and reddening of the earcanal, a greenish-tinted discharge, and sometimes a foul odor to the ear. Symptoms include itching, pain, tenderness upon manipulation of the pinna, a feeling of “fullness to the ear,” and hearing loss in those cases in which the swelling and/or discharge is severe enough to have fully obstructed the earcanal. However, otitis externa may often be present in the absence of one or more of these signs and symptoms. A common example of the latter is eczematous or seborrheic otitis, which is characterized by itching, excess scaling, thickening and cracking of the outer canal, and often secondary infection due to scratching with fingernails or instruments such as cotton-tipped applicators.

### The Development of Otitis Externa

The incidence of otitis externa in the general population is related to environmental or seasonal conditions, being more prevalent when temperature and humidity are elevated and/or when recreational water sports are common. It has been hypothesized that prolonged exposure to water removes the protective ceruminous layer, allowing the skin to soften and absorb moisture. This leads to swelling and obstruction of the sebaceous and ceruminous glands, thus preventing replacement of the cerumen. Itching results, which may give rise to scratching and more itching, and the situation worsens. Water-sports enthusiasts may prevent this condition by regular use of acidic alcohol drops (available over the counter) in each external canal after swimming.

Another common cause of otitis externa is excessive cleansing and scratching/digging at the earcanal. This not only removes the protective ceruminous layer and creates itching, but may result in trauma or abrasion that further breaches the skin’s protective barriers. This may result from regular aggressive cleaning of the earcanal with cotton-tipped applicators; if such applicators are used, they should be applied gently only to the outermost portion of the earcanal. Studies of patients with otitis externa have found a large majority reported cleaning

their earcanals with cotton swabs, matches, fingernails, or the like. A recent study of causes of otitis externa in children also concluded that use of a cotton-tipped applicator to clean the ear seems to be the leading cause of otitis externa in children.

### Recommendations for HPD hygiene

As with all clothing and equipment that comes in repeated and intimate contact with the body and the work environment, the cleanliness of HPDs must be considered. HPDs should be cleaned regularly in accordance with manufacturers’ instructions, and extra care is warranted in environments in which employees handle potentially irritating substances. Normally, warm water and soap are recommended as cleansing agents. Solvents and disinfectants should generally be avoided.

Earplugs should be washed in their entirety with mild non-abrasive soap and water and allowed to dry thoroughly before reuse or storage in their carrying containers. Earmuff cushions should be periodically wiped or washed clean. Their foam liners can also be removed for washing but must be replaced since they do affect attenuation. Earplugs and earmuff cushions should be discarded when they cannot be adequately cleaned or no longer retain their original appearance or resiliency.

Stressing hygiene beyond practical limits, however, can compromise the credibility of the HPD issuer/fitter. It is often difficult enough to get employees to replace or repair worn out HPDs, let alone clean them routinely. And in spite of this, the available epidemiological data give no indication that the use of HPDs significantly increases the prevalence of external ear disease.

### Closing Remarks

Examination of the physiology of the typical healthy earcanal suggests that its natural defense mechanisms render it resistant to infection. This observation is substantiated by the available anecdotal and epidemiological data on the prevalence of otitis externa among both users and nonusers of HPDs. For both groups prevalence is approximately 2%. Although hearing protection devices should not be worn in the presence of some preexisting earcanal pathologies, and care must be exercised regarding selection and use under certain environmental conditions, regular wearing of HPDs does not normally increase the likelihood of contracting otitis externa.

For additional information and references see Berger (1985) which can also be accessed on the web at:

[www.e-a-r.com/hearingconservation/earlog\\_main.cfm](http://www.e-a-r.com/hearingconservation/earlog_main.cfm)

Berger, E. H. (1985). “EARLog #17 — Ear Infection and the Use of Hearing Protection,” *J. Occup. Med.* 27(9), 620–623.